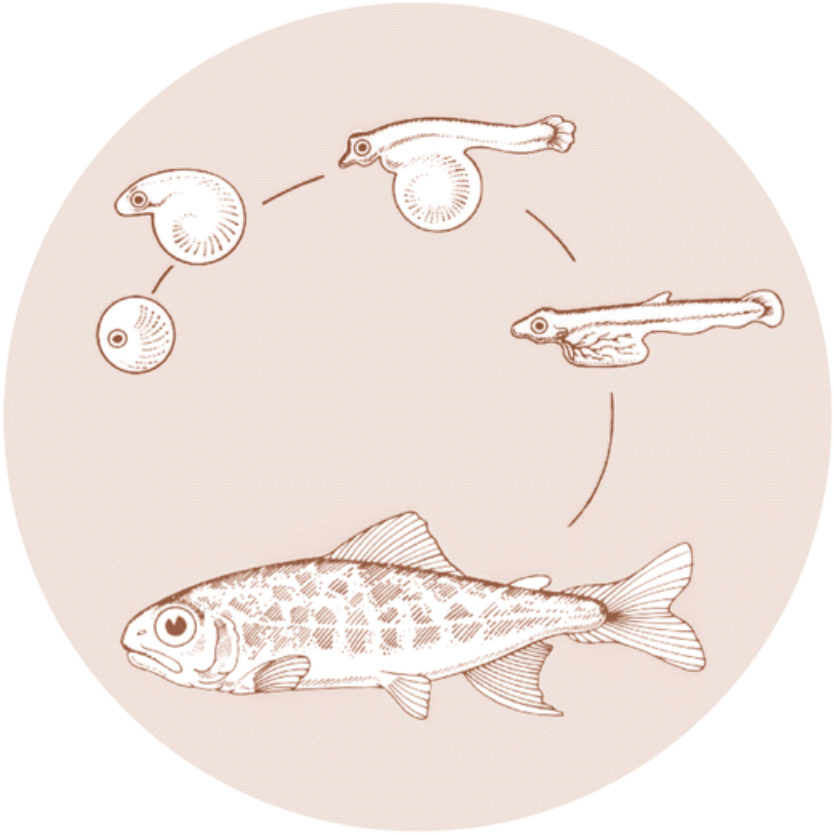
December 1993

AUGMENTED FISH HEALTH MONITORING IN IDAHO

Annual Report 1992



DOE/BP-65903-5

This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views of this report are the author's and do not necessarily represent the views of BPA.

This document should be cited as follows:

A. Douglas Munson, A. K. Hauck, Eagle Fish Health Laboratory, Augmented Fish Health Monitoring in Idaho, Annual Report 1992 to Bonneville Power Administration, Portland, OR, Contract DE-AI79-87BP65903, Project 87-117, 70 electronic pages (BPA Report DOE/BP-65903-5)

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AUGMENTED FISH HEALTH MONITORING IN IDAHO

Annual Report 1992

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Project No. 87-117
Contract No. DE-AI79-87BP65903

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ACKNOWLEDGEMENTS

Idaho Department of Fish and Game thanks Bonneville Power Administration for funding this project. We also would like to express our gratitude to Ron Morinaka and Rick Westerhof for the guidance for the duration of this project. Our appreciation to Stan Allen, Doug Reece and Steve Reece for producing the FDISEASE database. Roberta Scott, Sharon Wavra, Sharon Landin and Rosanne Lokker for their technical assistance and office work. All the IDFG anadromous hatchery crews are thanked. Tom Rogers and Bill Hutchinson are thanked for their guidance, direction and help in developing this program. Scott Foott should be thanked for getting this project started and headed in the proper direction.

ABSTRACT

This report documents the progress of Idaho Department of Fish and Game's fish health monitoring during the past five years and will serve as a completion report for the Augmented Fish Health Monitoring Project. Anadromous fish at twelve IDFG facilities were monitored for various pathogens and organosomatic analyses were performed to anadromous fish prior to their release.

A fish disease database has been developed and data is presently being entered.

Alternate funding has been secured to continue fish health monitoring.

INTRODUCTION

The Augmented Fish Health Monitoring project was initiated in 1986. This project was contracted for five years with Bonneville Power Administration (BPA) and five fish rearing agencies which included: Idaho Department of Fish and Game (IDFG), Oregon Department of Fish and Wildlife (ODFW), Washington Department of Fisheries (WDF), and U. S. Fish and Wildlife Service (USFWS).

Bonneville Power Administration attempted to standardize fish health sampling throughout the agencies and develop a standard reporting format. Furthermore, BPA provided means to improve communication between these agencies and suggested evaluation of smolts before release. This preliberation sample provided a means by which a comparison between similar groups could be made.

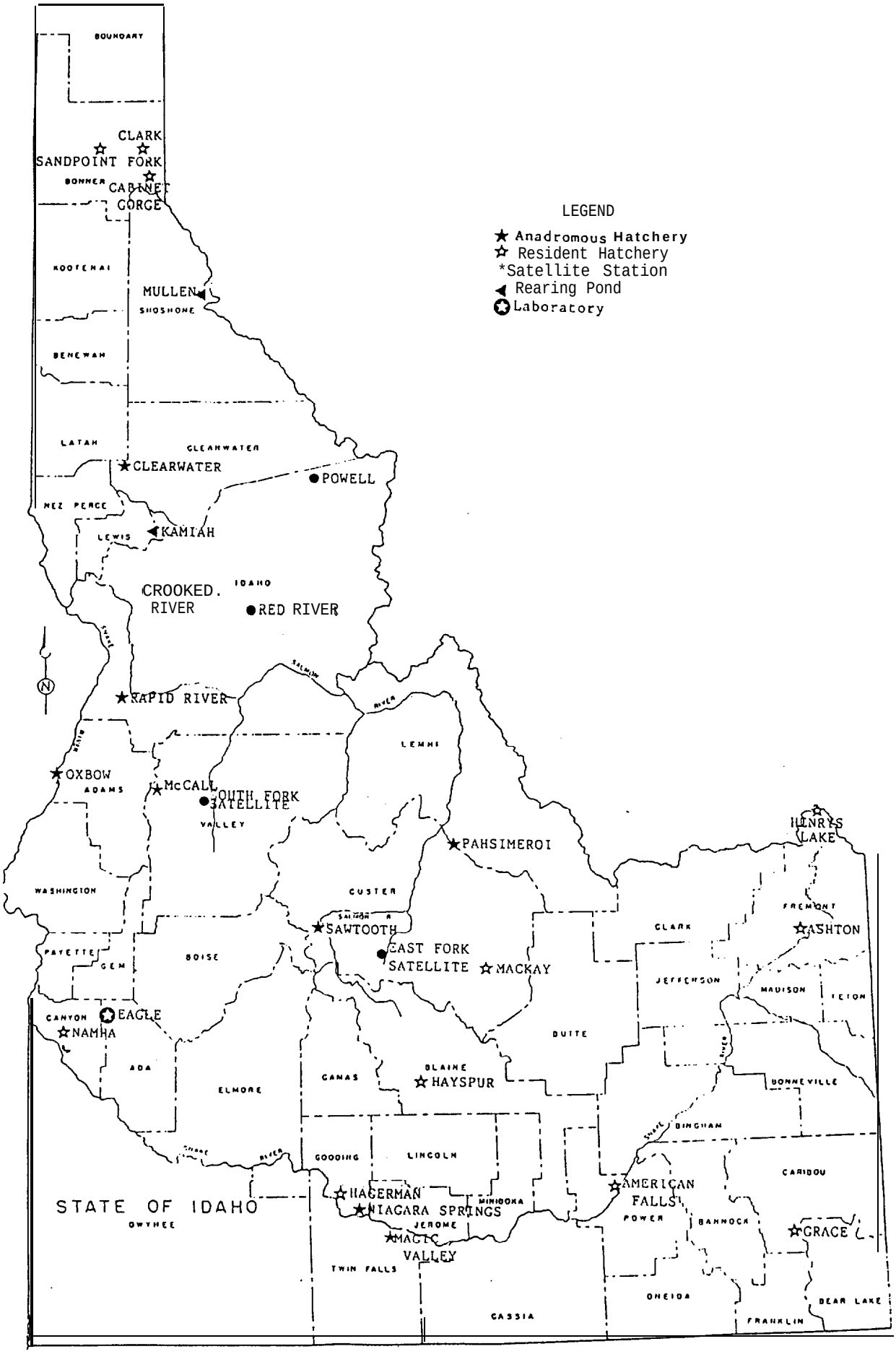
IDFG has participated in this project from the onset and has developed funding to continue fish health monitoring beyond the completion of this project. In this report, IDFG's participation will be evaluated, along with the techniques utilized by the Eagle Fish Health Laboratory. The data collected in 1990 and 1991 will be presented in this report. Previous years data and evaluations of those years can be found in the appropriate annual reports.

Table 1. List of upper Columbia River Basin anadromous facilities operated by Idaho Department of Fish and Game.

Facility	Water Source	Stock/species
Clearwater Hatchery+ Jerry McGehee, Manager Ahsahka, Idaho	Clearwater River	Clearwater spring chinook
Magic Valley Hatchery Bud Ainsworth, Manager Filer, Idaho	covered spring above Snake River	Pahsimeroi A steelhead, East Fork B steelhead, Clearwater B steelhead
McCall Fish Hatchery and South Fork Satellite Gene McPherson, Manager McCall, Idaho	Payette Lake	South Fork Salmon River summer chinook
Niagara Spring Hatchery Jerry Mowery, Manager Wendell, Idaho	uncovered spring above Snake River	Pahsimeroi and Hells Canyon A steelhead
Oxbow Hatchery Brent Snider, Manager Oxbow, Oregon	Snake River	Hells Canyon A steelhead adult holding/incubation)
Pahsimeroi Hatchery Bob Moore, Manager Ellis, Idaho	Pahsimeroi River	Pahsimeroi summer chinook, A steelhead
Rapid River Hatchery Tom Levendofske, Manager Riggins, Idaho	Rapid River	Rapid River and Hells Canyon spring chinook
Powell Satellite+ Jerry McGehee, Manager Ahsahka, Idaho	Lochsa River	Clearwater spring chinook
Red River Satellite+ Jerry McGehee, Manager Ahsahka, Idaho	South Fork Clearwater River	Clearwater spring chinook
Sawtooth Hatchery and East Fork Satellite Joe Chapman, Manager Stanley, Idaho	Salmon River	East Fork and Salmon River spring chinook

+ Not listed in BPA contract as part of augmented fish health monitoring project.

Figure 1. Location of Idaho Fish and Game fish propagation facilities.



Description of **Study Area**

Eight hatcheries, with five satellite facilities, release anadromous fish into the Salmon, Snake, and Clearwater drainages. These facilities produce steelhead and chinook smolts (except Oxbow, which is utilized as an adult holding and egg incubation station) . The South Fork Trap and the East Fork Trap are satellite facilities to McCall and Sawtooth hatcheries respectively. Powell, Red River, and Crooked River facilities are satellites to Clearwater Hatchery. Figure 1 will provide the location of each of these facilities and Table 1 will list the hatchery with the drainage and the species reared.

Evaluation and Review of Project

The goals of the Augmented Fish Health Monitoring project were:

Goal #l: Standardization of fish health technologies: This was accomplished early in the project via the steering committee meetings, where technical information and experiences were exchanged. Sample techniques and methodologies were agreed upon, thus all participating agencies were using the same technique and sampling at the same levels. This allowed interagency discussion of data to be more meaningful.

Goal #2: Develop common data collection and data reporting.

Currently a fish health/disease data base is being developed by IDFG's Bureau of Coordination. This data base is being produced on a Clipper format and should be completed soon. The program has

been developed to a state permitting data entry, which is being done at the present time.

An interface with hatchery computer data bases is being investigated. This would enable Eagle Fish Health Laboratory to interface with hatchery systems and gather information in a more timely and efficient manner.

Goal #3: Evaluate and Monitor Water Quality.

Although the Policy Review Group deleted funds in 1990-1991, IDFG has selected water quality parameters and laboratories to conduct the analysis. The results from these laboratories are sent to the pathologists at Eagle for interpretation. Water quality analysis will increase in the future.

Goal #4: Improve communication.

Participation in steering committee meetings and PNFHPC meetings has exacted benefits to IDFG fish health program which can not be measured. The constant change in techniques and philosophy requires each agency to participate in the exchange of ideas. A better understanding of pathogens such as Renibacterium, IPNV, and Ceratomvxa has provided the means by which effective management can be applied to combat these organisms.

Goal # 5: Annual evaluation of fish health information.

On an annual basis, IDFG was required to report to BPA the data gathered and the analysis of that data for that particular year. Fish health, juvenile and adult, was reported upon and the actions taken to reverse epizootics. From each annual report to BPA, IDFG reviewed the previous year's fish health sampling and was

then able to apply hatchery management suggestions to help alleviate some problems. IDFG realized the prevalence of BKD and the toll it takes in Idaho's chinook population. During the BPA project, IDFG implemented a culling program which has been credited with reducing IHN and IPN epizootics in our steelhead hatcheries. Experience and information exchange with other agencies has been most rewarding for IDFG.

EVALUATION OF SPECIFIC PATHOGENS

Viral Pathogens

Infectious hematopoietic necrosis virus (IHNV), the causative agent of IHN disease, is primarily a problem in our steelhead hatcheries. Throughout the five year BPA project, an occasional IHNV isolation was found in chinook stocks. Usually such isolations had no mortality. Both Niagara Springs and Magic Valley are located in the middle of Idaho's commercial trout industry. It is not uncommon for Niagara Springs Hatchery to experience an epizootic subsequent to an outbreak at an adjacent hatchery.

Both Niagara Springs and Magic Valley receive eggs from sources that are acknowledged carriers of viral pathogens (Sawtooth, Pahsimeroi, Oxbow and Dworshak). To reduce impact of this disease, IDFG has implemented 100% virus testing of all hatchery spawned steelhead (females). All egg lots from females that are high titered positive IHN are culled. All eggs are also disinfected with iodophor. These policies have been credited with reducing IHNV within Idaho's anadromous stocks. In the future, all

anadromous hatcheries will install effective bird netting in hopes or reducing horizontal transmission. Stringent sanitary protocols have also paid dividends in controlling IHNV.

Infectious pancreatic necrosis virus (IPNV), the causative agent of IPN disease, has been isolated at Magic Valley, Niagara Springs, Pahsimeroi (brood STA) and East Fork (brood EF STA). IPNV, more so than IHNV, can be transmitted vertically and is not completely eliminated via iodophor disinfection of the eggs. IDFG feels it is imperative to cull progeny from high titer females to control the impact of this disease. As with IHNV, iodophor disinfection of eggs (surface disinfection of egg), a culling program, stringent sanitary protocols, and bird netting play a role in avoiding and controlling this viral agent. IDFG will continue to control IPN through avoidance and sanitation protocols.

Erythrocytic inclusion body syndrome (EIBS), has been confirmed from one IDFG hatchery (Rapid River) and presumptively from another (Pahsimeroi, STA). After modifications were implemented to improve water circulation at Rapid River Hatchery, EIBS has virtually disappeared. Further inspection of IDFG hatcheries is warranted and will continue.

BACTERIAL PATHOGENS

Bacterial kidney disease (BKD), caused by Renibacterium salmoninarum (Rs) has been detected in all IDFG chinook stocks. At present, the focus of the fish health program for chinook in Idaho is the control of BKD. Recent developments in technology (ELISA,

enzyme linked immunosorbent assay) have given IDFG an ability to detect Rs at very low levels. Control measures for BKD have been effective in reducing mortalities in the hatchery life stages. Iodophor disinfection of eggs, prophylactic medicated feed treatments (erythromycin) and erythromycin injections of adults have been implemented to control BKD. Recently, IDFG changed protocol for injecting erythromycin into brood chinook. A subcutaneous route (dorsal sinus) was formerly employed; now an intraperitoneal (IP) route is utilized. We feel (and observe) better retention of the drug and less handling of the fish is needed to administer the injection. Further, through BPA funding, IDFG has implemented an ELISA based BKD segregation program. In light of new information of erythromycin feeding strategies, IDFG may change it's policies to integrate the BKD segregation program and application of erythromycin medicated feed to achieve a maximum protection.

Bacterial coldwater disease (CWD), caused by Flexibacter psychrophilus has caused mortalities in steelhead and chinook in IDFG hatcheries. Ubiquitous in nature, F. psychrophilus control, or more appropriate coldwater disease, depends on controlling stress in most cases. As densities are reduced at Niagara Springs, morbidity and mortality from F. psychrophilus decline. In epizootic situations oxytetracycline has been an effective treatment for this agent, if diagnosed early. Future control of cold water disease still focuses on reducing stress and providing a healthy environment. Perennial problem hatcheries, such as Rapid

River, will implement prophylactic medicated feed treatments (oxytetracycline) in order to reduce the impacts of this agent. Further, as soon as an INAD (investigational new animal drug permit) is established for injection of oxytetracycline into brood fish, IDFG will implement a brood injection program in order to control apparent vertical transmission of this bacteria. As with viral agents and BKD, iodophor disinfection of eggs appears to have been helpful.

Furunculosis, caused by Aeromonas salmonicida has been a problem at Niagara Springs, usually just prior to release of their juvenile steelhead. This pathogen has been resistant to oxytetracycline treatments, while Romet-30 treatments have been successful. Future control of furunculosis will include proper bird net installment, reduction of stress, and iodophor disinfection of eggs. Further investigations are needed to provide appropriate chemotherapeutic drugs to combat this agent.

Enteric Redmouth, caused by Yersinia ruckeri has not been a problem at IDFG anadromous hatcheries. It has not been cultured, nor have clinical signs of this disease been noticed during inspection service to these hatcheries.

PARASITIC PATHOGENS

Whirling Disease, caused by Myxobolus cerebralis has been isolated on a yearly basis at Pahsimeroi and Sawtooth hatcheries in returning adults and juvenile chinook salmon (PAH SU, SAW SC, & EF SC). It has been also isolated in the corresponding steelhead

stocks from these stations (PAH STA, SAW STA, & EF STB). It is difficult to ascertain the exact impact of this disease. Although circumstantial, infected stocks have declined dramatically since this parasite established itself in these drainages. Eagle Fish Health Laboratory has documented that outmigrating smolts have intensities of Myxobolus while returning anadromous fish to these hatcheries are either negative to Myxobolus or carry low infections of this parasite.

Currently, a program to early rear PAH SU chinook at Sawtooth Hatchery until the fish reach 7 cm in length and then move these fish to the Pahsimeroi ponds has been implemented. Approximately one third of the fish will be early reared on Sawtooth spring water. If progress isn't realized through this program, hatchery modifications will be sought after by IDFG to eliminate this parasite.

Ceratomyxa Shasta, which causes ceratomyxosis, has been detected (in noninfectious spore stage) in all anadromous stocks. The infective spore stage has not been isolated in our juvenile stocks while being raised in the hatchery.

Proliferative Kidney Disease (PKD), signs were not seen during inspections nor were they detected during routine sampling throughout the duration of this project.

Ichthyophthirius multifilis ("ICH"), has caused mortalities at Red River ponds in August, 1989. In August of 1991, I. multifilis was successfully treated with formalin (167 ppm). Stringent cleaning of the ponds and close observation should insure epizootics will be minimized.

SITE SPECIFIC RECOMMENDATIONS

(This list of impediments and recommended corrections was originally presented by Foott & Hauck, 1989)

A. Rapid River Hatchery

1. IMPEDIMENT - The earthen adult pond 2 has poor flow characteristics which impact any chemical flush treatments (hot spots). It also receives effluent from production pond 1 which can subject the adults to disease transmission from and chemotherapeutics being presented to the juveniles.

   CORRECTION - Remodel adult pond 2 into a multiple section concrete unit with an independent well or river water source (well water cooler than river).

   STATUS: Ponds remodeled to increase circulation of river water.

2. IMPEDIMENT - The water supply for production pond 1 must pass through the nursery raceway system prior to entering the pond. The raceways do not contain fry when the production pond is in operation. Stagnant water and organic accumulations in the idle raceways are thought to contribute to bacterial gill disease epizootics at this station.

   CORRECTION - Build a pipeline to pond 1 which bypasses the raceways.

   STATUS: Completed.

3. IMPEDIMENT - The accumulation of organic matter and fish carcasses in the ponds act as a reservoir for fungal,

parasitic, and bacterial pathogens.

STATUS: No change.

4. IMPEDIMENT – The hatchery receives its entire water supply from Rapid River, which contains resident fish and migratory adults that are allowed to spawn above the hatchery trap. Several horizontally-transmitteddiseases (EIBS, BKD, Saprolegnia, bacterial gill disease) have a major impact on smolt production.

CORRECTION – Conduct feasibility study on the engineering requirements for a filtration and disinfection system for the entire hatchery.

STATUS: Study completed. No change in facility.

B. McCall Hatchery

1. IMPEDIMENT – Sediment deposition in the incubators which causes egg suffocation.

CORRECTION – Build a sediment trough for incubator water supply.

STATUS: Completed 1988.

2. IMPEDIMENT – Low flows and high water temperatures at the South Fork trap increase prespawning adult mortality due to Saprolegnia.

CORRECTION – Decreasing water temperature via well water may be a possible solution, although the danger of electrical power loss and the unknown effect of well water on homing may make this option unfeasible.

STATUS: No change.

C. Sawtooth Hatchery

1. IMPEDIMENT - Adult trap and spawning facility receives its water supply from the hatchery effluent pond. This situation exposes the adult broodstock to chemotherapeutic effluent, pathogens shed by the juveniles, and low quality water (warmer temperatures than river, high organic content, low dissolved oxygen).

   CORRECTION - Direct settling pond effluent to the river and supply adult ponds with well (lower temperature and pathogen load then river water) or river water. Well water could affect homing and may not be a viable substitute for river water.

   STATUS: No change.

2. IMPEDIMENT - The river supplies the majority of the hatchery's outside raceways and selected inside vats. Resident fish and migratory adults, which are allowed to spawn above the hatchery trap, are present in the river. Several horizontally-transmitted diseases (BKD, Saprolegnia, external parasites, Myxobolus cerebralis, bacterial gill disease) have an impact on smolt production.

   CORRECTION - Conduct feasibility study on the engineering requirements for a filtration and disinfection system for the entire hatchery.

   STATUS: Study complete. No change in facility.

3. IMPEDIMENT - Solid waste removal activities (sweeping) cause both injury and a stress reaction in juveniles.

The high altitude (6,500 ft) increases sunburn problems.

CORRECTION - Install baffles in outside raceways to both flush wastes and provide shade.

STATUS:

D. Pahsimeroi Hatchery

1. IMPEDIMENT - A high prevalence and intensity of infection for Myxobolus cerebralis occurs in the production chinook. Tubifex worms have been documented to be the intermediate hosts for this parasite (Wolf & Markiw, 1984), and are ubiquitous fauna to earthen ponds. The accumulation of organic matter and fish carcasses in the ponds acts as a reservoir for fungal, parasitic, and bacterial pathogens.

   CORRECTION - Cover earthen pond bottoms.

   STATUS: No change.

2. IMPEDIMENT - Transmission of fish pathogens (M. cerebralis, BKD, external parasites) from river water to juveniles.

   CORRECTION - Conduct feasibility study on the engineering requirements for a filtration and disinfection system for the entire hatchery (or) provide alternate (well) water source.

   STATUS: Study complete. No change in facility.

E. Oxbow Hatchery

1. IMPEDIMENT - The high temperatures and sediment loads of the Snake River in the spring are detrimental to egg incubation.

CORRECTION – Supply well water for incubation and early rearing.

STATUS: Complete.

2. IMPEDIMENT - The hatchery is located below Oxbow dam and is thus potentially subjected to gas supersaturation in times of high spills. A chronic septicemia problem (see Task 3.2, Adults) may have been related to the debilitation effects of subacute gas supersaturation.

CORRECTION - Measure supersaturation and provide facility corrections as needed. Continuous monitoring equipment situation in-line is recommended to detect shifts in gas supersaturation and correlate them with mortality.

STATUS: Complete.

3. IMPEDIMENT - Prespawning mortality of brood steelhead has been associated with systemic infections Flexibacter psvchrophilus and Aeromonas spp.

CORRECTION - Inject oxytetracycline to reduce or eliminate mortalities utilizing an intraperitoneal route.

STATUS: Over the last two years this injection process has reduced prespawning mortality significantly at this facility.

F. Niagara Springs Hatchery

1. IMPEDIMENT - High densities in the nursery vats due to inadequate space.

CORRECTION - Increase nursery space (building and tanks).

STATUS: No change.

2. IMPEDIMENT - Potential horizontal transmission of fish

pathogens to steelhead by birds moving between adjacent commercial facility with history of IHNV outbreaks and Niagara Springs hatchery.

CORRECTION - Bird wires and fencing of raceway area.

STATUS: Bird wires to be put in 1993.

3. IMPEDIMENT - The facility experiences chronic myxobacteriosis throughout the rearing cycle, and the springs which supply the hatchery contain resident fish which are potential sources of pathogens.

CORRECTION - Conduct feasibility study on the engineering requirements for a filtration and disinfection system for the entire hatchery, Alternate: eradicate fish from springs and cover springs.

STATUS: No change.

G. Magic Valley Hatchery

1. IMPEDIMENT - Higher than optimal gas supersaturation levels (106-109%) detected in1988 constitute a potential stressor to steelhead stocks (see Task 4.1).

CORRECTION - Engineering study to determine the cause of this situation and provide measures to decrease gas supersaturation level of water supplied to raceways.

STATUS: No change.

H. General recommendations applicable to all anadromous stations.

1. All facilities using surface water have the capacity for filtration and disinfection of their entire water supply. Water disinfection is recommended for such facilities to optimize fish health. The ultimate goal is for a water

supply free of Class A and B pathogens (Pacific Northwest Fish Health Protection Committee categories).

2. Provide well water supplies for all early rearing and broodstock facilities in order to reduce chemical usage and improve water quality.
3. Each earthen pond should be converted to a rearing container which can be cleaned of organic matter and fish carcasses on a periodic basis during the rearing cycle.
4. Baffles should be installed in all rearing units where practical.
5. Bird and animal protection should be given to all outside rearing containers.
6. Formalin delivery systems should be installed at all broodstock and egg incubation facilities to meet OSHA standards and optimize treatment efficiency.

Clearwater Hatchery (Crooked River, Red River, and Powell)

Clearwater Hatchery came on-line in the Spring of 1992. A group of Mt. Lassen RBT are being reared (as **a** system test) in the steelhead and chinook raceways before anadromous fish are placed in these systems.

An immediate concern for this facility is to complete the installation of bird netting around both chinook and steelhead raceways. Indoor and outdoor raceways should have baffles installed. Outdoor raceways should have devices that give shade to the fish. Both baffles and shading devices should be easily cleaned and not a problem to fish culture.

Pathogens of concern are IHNV for the steelhead and BKD for the chinook. Brood fish of either species will be screened for these particular pathogens (100% sampling of brood females). Either a segregation program or a cull program will be implemented to reduce the impacts of these diseases. Erythromycin medicated feed and the feeding strategies that have been presented to IDFG hatchery personnel, will be implemented at Clearwater Hatchery and evaluated for effect.

Since IHNV has been a problem at Dworshak NFH, Eagle Fish Health Laboratory has suggested a IHNV control program based on the Big Lake State Fish Hatchery (1987) IHNV program sockeye culture.

CLEARWATER HATCHERY STANDARD & PATHOLOGICAL PRACTICES

1. No one is to enter the incubation modules unless they have a specific, assigned duty.
2. No public tours will be conducted inside of the indoor raceways.
3. The incubation area is not a thoroughfare, go around when possible.
4. No one is to touch any incubator unless they have a specific, assigned duty.
5. To prevent upstream contamination, only work downstream on the egg incubators.
6. Disinfect hands and tools before touching or working with an incubator.
7. When going from one incubator to another disinfect hands and tools.
8. When common equipment is being used for chinook and steelhead, be sure that it is disinfected.
9. Raingear, hipboots and chestwaders, if used at the satellite facilities will not be worn into the indoor raceways unless soaked in a betadine solution.
10. Disinfect hatchery floor and lower walls weekly with betadine or more often as the traffic warrants.

11. Chlorine footbaths are to be checked weekly for strength.

12. Eggs are to be treated two to three times a week with fungicide.

13. Eggs and fry that are dropped on the floor are to be considered contaminated and they are to be destroyed if eggs and flushed down the drain if fry.

14. Use the attitude that all steelhead equipment, eggs and fry are contaminated with IHNV and act accordingly.

15. A visual check of water flows and plumbing on incubators and raceways will be made daily.

16. The buffer area and incubation modules need to be kept as clean as possible.

17. Disinfect hand tools when bringing them into the hatchery from the shop.

Crooked River

Fish reared at Crooked River appeared to do well at this satellite facility. A major loss due to anoxia will be discussed by the hatchery manager.

A water intake system in the river bed is already under construction, as well as a cabin at the pond site with a modern alarm system linked to the rearing ponds. In the future, strategies for application of erythromycin medicated feed will be analyzed. A protocol that allows maximum absorption of the drug will be investigated.

Red River

In past years, Red River has experienced mortality from Ichthyophthirius multifilis. This protozoan parasite is capable of explosive reproduction within very short periods of time. Another area of concern at Red River is the high water temperatures experienced during the summer. As the temperatures rise, "Ich's" life cycle accelerates, with the optimum near 70 F. The chinook begin to experience stress as the temperatures approach the upper

60's F. The Red River satellite needs a cool water well to help maintain optimum temperatures for rearing juveniles and holding brood fish. In the summer of 1991, I. multifilis was successfully controlled with formalin at this site.

Powell

Fish health at Powell in the past year was very good. Concern should be taken at the amount of sediment that comes down Walton Creek into juvenile and brood ponds after rain storms. The Powell District of the USFS has been cooperative in attempts to limit the sediment. Further cooperation is needed to stabilize areas subject to logging, both on federal and private acreage, before erosion becomes a problem.

Magic Valley Hatchery

Steelhead stocks at Magic Valley, in general, improved in appearance and in fish health. Fin quality remained excellent until the final weeks of rearing. Magic Valley changed protocol in early rearing from a trout starter diet to a salmon starter diet. Feeding strategies were also changed from a constant low rate to intermittent feeding at a higher rate. This strategy was implemented towards the end of the rearing period to lessen fin erosion.

IHNV was isolated in one pool of kidney/spleen/pyloric caeca of EF STB (lab accession 91-203). No mortality could be attributed to this virus. All brood EF STB for 1991 were examined for virus and tested negative.

Preliberation examinations showed that the stocks from Magic Valley appeared to be void of serious pathogens. Fin quality had improved over previous years, while these fish appeared to be more

robust than previous years. These improvements in fish quality are probably due to the changes in feeding protocol mentioned at the beginning of this hatchery section.

Magic Valley receives fish from Oxbow, Pahsimeroi, Dworshak and Sawtooth (East Fork trap) hatcheries. Currently, stringent sanitation measures are implemented after smolt release, to facilitate virus control. We feel this has paid dividends in disease control.

Prophylactic feeding of oxytetracycline will be discontinued **at** Magic Valley. After discussions with Bud Ainsworth, superintendent III of Magic Valley Hatchery, Eagle Fish Health Laboratory suggested termination of this program. In the past cold water disease had not been a problem, and thus prophylactic feeding will not be needed.

McCall Hatchery

In 1991, Eagle Fish Health Laboratory suggested a strict interpretation of the existing INAD established for the usage of erythromycin medicated feed. The protocol used was **a 14** day application rather than a 21 day. The preliberation sample found an unusually high number of.Renibacterium positive fish.

Just prior to sampling, an otter was seen several days in a row depredating the fish in pond 2. This pond showed three times as many positives (BKD+, 10/30) as did pond 1 (BKD+, 3/30).

Organosomatic data showed that the mesenteric fat averaged between 3 and 4. (A mesenteric fat level of 3 indicates more than 50% of pyloric cecum is covered with fat, while a mesenteric fat level of 4 indicated pyloric cecum covered by a large amount of fat). This goal was established by the McCall Hatchery staff

earlier in the growing season. The stored energy in the adipose deposits may help the smolt make the transition from a hatchery habitat to the wild. Further data collection is warranted regarding optimum mesenteric fat levels for hatchery smolts.

In general, fish health parameters were maintained at optimum levels for juvenile fish. Areas of main concern should be focused at the South Fork Trap. A well with a source of cool water could be utilized to maintain optimum water temperatures for brood fish in the holding ponds. A modern crowding apparatus could be considered to lessen stress on the brood fish being held at this trap. Possibly in the future, a culling program could be implemented to remove high
BKD+ egg lots.

Niagara Sprinss Hatchery

In past years Niagara Springs has had disease problems from many etiologic agents such as IPNV, IHNV, Aeromonas salmonicida, and Flexibacter psvchrophilus. The location of Niagara Springs, within the heart of the commercial trout industry, makes this hatchery vulnerable to horizontal transmission of many etiologic agents. Furthermore, the hatchery and spring (water source) are located directly below agricultural land, exposing both to toxic drift from pesticides being sprayed on the fields above the hatchery. Distinct behavioral changes are exhibited after one of these spraying events.

In the past year, Niagara Springs has reduced the number of steelhead reared in the raceways to facilitate a better quality smolt and less disease problems. In 1991 there were less problems with Flexibacter psvchrophilus and no epizootics from serious

pathogens. Fin quality improved significantly in low density raceways and these same raceways produced a larger, more robust smolt.

Hell's Canyon STA experienced elevated mortality associated with the initiation of prophylactic feeding of oxytetracycline. Both viral and bacterial assays (91-183) were negative. These fish exhibited exophthalmus, scoliosis, liverlipoid degeneration (fatty livers) and anemia. Upon investigation with the Niagara Springs crew, the medicated feed was found to be covered with a green mold. This suggests that the signs being exhibited by the fish were due to aflatoxins or mycotoxins, poor amino acid content, or deficient vitamin content. The moldy feed was replaced and the fish health changed to normal almost immediately.

Virus (IHNV & IPNV) will continue to be the main concern at this hatchery. A stringent sanitation program is implemented to facilitate disease control. Bird netting must be installed to control horizontal transmission of the aforementioned etiologic agents. Idaho Power has projected the installation of the netting in 1993. Furthermore, a route for etiologic agents to enter this hatchery is through the water source. The bridge crossing the spring is used daily by commercial fish hauling trucks. These trucks often splash water from their tanks, as they cross the bridge, thus contaminating the spring. Improvements on this bridge would certainly pay dividends in disease control. Currently, water sampling bottles, for pesticides, have been stored at Niagara Springs. In the future, we hope to document the amounts of chemical drift the spring and hatchery receive and ascertain the acute and chronic effects on the steelhead.

Oxbow Hatchery

In recent years, the focus of the Eagle Fish Health Laboratory (for Oxbow) has been to improve Oxbow's incubation water source. Very poor egg survival was attributed to the water used in egg incubation. This water (Snake River) has a very high silt content, an unacceptable pH (8.51, high nitrates and various other pollutants (including arsenic). Idaho Power Company has drilled two new wells for incubation and significant increases in egg survivability should be attributed to this improvement.

Due to the length of holding of the steelhead, prespawning mortality can be a serious problem. Oxytetracycline injections have proven to be effective in limiting losses.

Water analysis below Hell's Canyon Dam revealed acutely lethal levels of copper (0.29 ppm) in Deep Creek. Deep Creek flows directly into the Snake River directly across from the fish trap that services Oxbow. Other heavy metals found in detectable concentration were lead, cadmium, and arsenic. Synergistic effects do occur from contaminations with heavy metals, such that trace amounts of several elements can have an enhanced detrimental effect. Egg survivability has been correlated to adult exposure to heavy metals, even for brief periods. Furthermore, there is evidence that heavy metals affect the migratory ability of anadromous fish.

In the future, Oxbow needs to update adult holding ponds, crowding apparatus, and spawning area. In particular, the crowding apparatus should be considered a safety concern. Since malachite green is no longer to be used as a antifungal agent, other chemicals such **as** formalin and iodine will be experimented for

ability to control fungus at this facility. Oxytetracycline injections, to control prespawning mortality, will continue utilizing an intraperitoneal route. This route reduces handling time and stress, allowing the injection crews to work the fish safely.

Pahsimeroi Hatchery

Pathogens of concern at this facility are Myxobolus cerebralis (whirling disease), IPNV and Renibacterium salmoninarum (BKD). In early raceway rearing, the water source is turbid and bacterial gill disease (BGD) is a chronic problem. Usually BGD is caused by the filamentous bacteria of the genus Flavobacterium. Flexibacter psychrophilus can also be found at this facility, but usually does not cause problems.

Presently, the focus of fish health at this station is controlling whirling disease and BKD. Efforts are being initiated to early rear the juvenile chinook in SPF (specific pathogen free) water source. This procedure may lessen the impact of M. cerebralis by allowing ossification to harden the skeleton of the fish and thus becoming less susceptible to infection. If the impacts of this procedure is not significant in reducing the disease, more conventional methods of fish culture (concrete raceways) will be suggested.

Pahsimeroi Hatchery, like other IDFG anadromous hatcheries, is using erythromycin to limit infection and disease from Renibacterium salmoninarum (BKD). In the future, different medicated feeding strategies may be implemented to enhance drug absorption by the fish. Of the anadromous hatchery stocks of IDFG, Pahsimeroi has the lowest prevalence of BKD in brood and juvenile

fish (determined by ELISA).

IPN can only be controlled by destroying sick fish. To do otherwise would amplify and disseminate the etiologic agent. A program of destroying high titer eggs has been implemented at this station. This program should be continued and involve a cull/segregation program.

Special care should be taken by the personnel at Pahsimeroi and Sawtooth hatcheries, so that fish, equipment and other possible vectors do not transfer etiologic agents from one hatchery to the other.

RAPID RIVER HATCHERY

The 1990 juvenile fish reared at Rapid River Hatchery appeared to be healthy through the summer of 1991. During this early rearing period, two medicated feedings of erythromycin were applied for 14 days apiece.

As the water temperatures dropped in the fall, the incidence of "fuzzy tail" increased. "Fuzzytail" syndrome is a visible fungal and bacterial (usually filamentous bacteria) infection which usually follows periods of stress such as clipping or chronic infections of Flexibacter psvchrophilus. Upon inspection by necropsy, virtually 100% of the moribund fish were showing internal lesions (kidney abscesses) consistent with BKD (Renibacterium salmoninarum) and external lesions consistent with cold water disease (CWD) (Flexibacter psychrophilus). At this time, the water temperatures were too cold to administer antibiotic therapy. During the course of the fall, winter, and early spring, Rapid River lost approximately 150,000 chinook to "fuzzy tail" syndrome. Preliberation samples and organosomatic analysis revealed a portion

of the population infected with R. salmoninarum. Most parameters showed that these were normal fish. Eyes and gills (frayed) will be areas to seek improvement. ELISA (enzyme linked immunosorbent assay) for Renibacterium showed that six pools (10 fish/pool) were positive out of six pools taken (100%). Three pools had optical densities that were considered high and three pools in the low range.

Rapid River has the potential to improve the fish health quality by several actions. As soon as an INAD is available for injecting oxytetracycline into adult chinook, a program to combat prespawning mortality should be implemented utilizing an intraperitoneal route. Oxytetracycline medicated feed should be administered in prophylactic feedings at least twice a growing season. This should help lessen the "fuzzy tail" problem. Erythromycin feeding protocols will be analyzed to provide Rapid River chinook the best protection possible. In the near future, either a BKD segregation program or a BKD cull program should be implemented.

All of these fish health related programs should produce a healthier fish by release and a better survival rate to Lower Granite Dam. Each project should be set-up correctly and analyzed thoroughly to ascertain the benefits of each hatchery protocol.

Sawtooth Hatchery

Several programs that will be implemented in the near future at Sawtooth Hatchery, such as baffles and shade for the outside raceways, will help raise a better smolt. A BKD segregation program was implemented at this hatchery in 1991, with apparent success in limiting mortalities to high BKD raceways(91-153 & 154).

Important pathogens found at Sawtooth hatchery are Renibacterium salmoninarum (BKD), Myxobolus cerebralis (whirling disease), Diplostomum spp. (eye fluke), and Flexibacter psychrophilus (Cold Water Disease). Both Myxobolus and Diplostomum have been controlled with concrete raceways. Although Flexibacter is ubiquitous in the environment, cold water disease is not expressed at this hatchery unless stressful conditions predispose the fish to disease. In times of warm water temperatures or handling, some fish will show the typical signs of this disease. The focus of the fish health program at Sawtooth is to control BKD.

In 1991, strict enforcement of the erythromycin INAD restricted medicated feed treatments to 14 days. This protocol was not completely effective in controlling BKD at this station. In the future the protocols stated in the INAD 4333 for Sawtooth Hatchery call for 21 day treatment for production fish and 28 day treatment for high BKD segregation groups. In the future, erythromycin feeding strategies will include protocols which might enhance absorption of the drug.

Although the well at Sawtooth Hatchery is sufficient for early rearing (indoor raceways), supplemental wells are needed to supply 50+ F water to keep the water intake free of ice in the winter. Furthermore, during the summer river water temperatures reach 70+ F. Cool water could be mixed with river water to maintain optimum rearing temperatures.

CONCLUSIONS

Idaho Department of Fish and Game has participated in the BPA Fish Health program since 1987. From this program many benefits were derived. Funding for the necessary personnel to staff a fish health program was gained and necessary equipment was purchased. A fish health program was initiated for anadromous hatcheries, while production constrains were identified for each hatchery. Idaho's participation was enhanced by information exchanges with other agencies in the Pacific Northwest to ensure health and quality of anadromous hatchery reared fish.

Establish an inspection program for anadromous hatcheries.

The technology to accurately assay and analyze fish health data from the fish from 11 anadromous facilities.

Hatchery impediments.

- Fish health database.

Several elements of the BPA Augmented Fish Health Monitoring project will be continued.

Adult and juvenile inspections.

- Database for storing fish health information.

Interagency communications.

- Hatchery diagnostic services.

Post project needs

Better methods and/or strategies to reduce the impacts of BKD, coldwater disease and IHN.

To address the list of hatchery impediments to fish health. This alone may reduce or eliminate many of the inherent disease problems at each hatchery. Sufficient disease free

water supplies would greatly reduce many of the problems found at hatcheries which utilize surface water supplies.

Wild fish health survey. Many demands are being made to survey and analyze what pathogens are being carried in the wild populations (wild and resident). Federal and State agencies are the preferable laboratories to get the information accumulated and an unbiased analysis performed.

LITERATURE CITED

Foott, J. S. and A. K. Hauck. 1989. State of Idaho Augmented Anadromous Fish Health Monitoring Annual Report 1988.

Goede, R. W. 1988. Fish Health/Condition Assessment Procedures. Utah Division of Wildlife Resources. Logan, Utah. 28 PP.

Hauck, A. K. and A. D. Munson. 1992. Assessment of Effect of Endemic and Introduced Fish Pathogens on Chinook and Sockeye in Idaho.

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Table 2a.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-059
SPECIES: STA
STRAIN: HC
UNIT: RWY 3
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): **D.** MUNSON
REMARKS: DENSITY INDEX .33

LOCATION: MV
AUTOPSY DATE: 03/04/92
AGE: JW
SAMPLE SIZE: 15

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	192.13	23.81	0.12
WEIGHT	72.86	24.26	0.33
KTL*	0.98	0.05	0.05
CTL**	0.00	0.00	0.00
HEMATOCRIT	44.46	6.14	0.14
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	5.23	0.69	0.13

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES		GILLS		PSEUDO-BRANCHES		THYMUS		MESEN. FAT		SPLEEN		HIND GUT		KIDNEY		LIVER		BILE	
N	15	N	14	N	15	0	15	0	0	B	15	0	15	N	15	A	9	0	13
Bl	OF	1		S	0	1	0	1	0	R	0	1	0	s	0	B	7	1	2
B2	OC	0		L	0	2	0	2	1	G	0	2	O	M	0	c	02		0
El	OM	0		S&L	0			3	1	NO	0			G	0	D	03		0
E2	OP	0		I	0			4	13	E	0			U	0	E	0		
Hl	OOT	0		OT	0	$\bar{X}$= 0.00				OT	0	$\bar{X}$= 0.00		OT	0	F	0		
H2	0			0	0			$\bar{X}$= 3.80								OT	0	$\bar{X}$=0.00	
Ml	0																		
M2	0																		
OT	0																		

SUMMARY OF NORMALS

100	93	100	100	0	100	100	100	100	0

SEX M: 0 F: 0 U: 0

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GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 2b.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-060 LOCATION: MV
SPECIES: STA AUTOPSY DATE: 03/04/92
STRAIN: PAH AGE: JUV
UNIT: SAMPLE SIZE: 15
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS: DENSITY INDEX .25 WILL BE GOING TO SAWTOOTH

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	174.67	28.15	0.16
WEIGHT	57.33	26.26	0.46
KTL*	1.00	0.05	0.05
CTL**	0.00	0.00	0.00
HEMATOCRIT	40.20	4.57	0.11
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	5.35	1.45	0.27

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES	GILLS	PSEUDO-BRANCHES	THYMUS	MESEN. FAT	SPLEEN	HIND GUT	KIDNEY	LIVER	BILE
N 15	N 14	N 15	0 15	0 O	B 15	O15	N 15	A 13	0 7
Bl OF 1	S 0	1 0	1 0	1 0	R 0	1 0	s 0	B 2	1 8
B2 OC 0	L 0	2 0	2 0	2 0	G 0	2 O	M 0	c 02	0
El OM 0	S&L 0		3 0	NO 0		G **0**	**D** 03		0
E2 OP 0	I 0		4 15	E 0		U 0	E 0		
Hl OOT 0	OT 0	$\bar{X}$= 0.00	OT 0	$\bar{X}$= 0.0OT		0	F 0		
H2 0	0 0		$\bar{X}$= 4.00				OT 0		$\bar{X}$=0.00
Ml 0									
M2 0									
OT 0									

SUMMARY OF NORMALS

100 93 100 100 0 100 100 100 100 0

SEX M: 0 F: 0 U: O

GENERAL REMARKS

FINS: GONADS:

SKIN: OTHER:

Table 2c.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-061
SPECIES: STB
STRAIN: EF
UNIT:
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS: DENSITY INDEX .19

LOCATION: M-V
AUTOPSY DATE: 03/04/92
AGE: JW
SAMPLE SIZE: 15

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	197.66	19.51	0.10
WEIGHT	78.43	22.22	0.28
KTL*	0.98	0.04	0.04
CTL**	0.00	0.00	0.00
HEMATOCRIT	41.73	5.51	0.13
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	5.24	0.46	0.09

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES		GILLS		PSEUDO-BRANCHES		THYMUS		MESEN. FAT		SPLEEN		HIND GUT		KIDNEY		LIVER		BILE	
N	15	N	15	N	15	0	15	0	0	B	15	0	15	N	15	A	12	0	0
Bl	0	F	0	S	0	1	0	1	0	R	0	1	0	s	0	B	3	1	3
B2	0	C	0	L	0	2	0	2	0	G	0	2	0	M	0	c	02		7
El	0	M	0	S&L	0			3	0	NO	0			G	0	D	03		5
E2	0	P	0	I	0			4	15	E	0			U	0	E	0		
Hl	OOT		0	OT	0	$\bar{X}$= 0.00				OT	0	$\bar{X}$= 0.00T			0	F	0		
H2	0			0	0			$\bar{X}$= 4.00								OT	0	x=2.13	
Ml	0																		
M2	0																		
OT	0																		

SUMMARY OF NORMALS

100	100	100	100	0	100	100	100	100	0

SEX M: 0 F: 0 U: 0

GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 2d.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-062
SPECIES: STB
STRAIN: DWO
UNIT: 10
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS: DENSITY INDEX .29

LOCATION: MV
AUTOPSY DATE: 03/04/92
AGE: JW
SAMPLE SIZE: 15

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	218.60	15.19	0.07
WEIGHT	107.70	20.97	0.19
KTL*	1.02	0.08	0.07
CTL**	0.00	0.00	0.00
HEMATOCRIT	44.00	6.01	0.14
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	4.49	0.81	0.18

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES		GILLS		PSEUDO-BRANCHES		THYMUS		MESEN. FAT		SPLEEN		HIND GUT		KIDNEY		LIVER		BILE	
N	15	N	9	N	15	0	15	0	0	B	15	0	15	N	15	A	15	0	14
Bl	0	F	6	S	0	1	0	1	0	R	0	1	0	s	0	B	0	1	1
B2	0	C	0	L	0	2	0	2	0	G	0	2	0	M	0	c	02		0
El	0	M	0	S&L	0			3	0	NO	0			G	0	D	03		0
E2	0	P	0	I	0			4	15	E	0			U	0	E	0		
Hl	0	OT	0	OT	0	$\bar{X}$= 0.00				OT	0	$\bar{X}$= 0.00		OT	0	F	0		
H2	0			0	0			$\bar{X}$= 4.00								OT	0	$\bar{X}$=0.00	
Ml	0																		
M2	0																		
OT	0																		

SUMMARY OF NORMALS

100 60 100 100 0 100 100 100 100 0

SEX M: 0 F: 0 U: 0

GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 2e.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-044A
SPECIES: SF
STRAIN: SU
UNIT: POND 2
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS:

LOCATION: MC
AUTOPSY DATE: 02/02/92
AGE: JUV
SAMPLE SIZE: 30

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	117.50	9.09	0.07
WEIGHT	17.50	4.28	0.25
KTL*	1.04	0.08	0.08
CTL**	0.00	0.00	0.00
HEMATOCRIT	44.30	2.29	0.05
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	9.05	1.13	0.13

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES	GILLS	PSEUDO-BRANCHES	THYMUS	MESEN. FAT	SPLEEN	HIND GUT	KIDNEY	LIVER	BILE
N 30	N 24	N 30	0 30	0 0	B 0	0 30	N 29	A 00	7
Bl OF 6	S 0	1 0	1 12	R 30	1 0	s 0	B 28	1 23
B2 OC 0	L 0	2 0	2 3	G 0	2 0	M 0	c 22	0
El OM 0	S&L 0	3 10	NO 0	G 0	D 03	0
E2 OP 0	I 0	4 15	E 0	U 1	E 0
H1 OOT 0	OT 0	$\bar{X}$= 0.00	OT 0	$\bar{X}$= 0.00	OT 0	F 0
H2 0	0 0	$\bar{X}$= 3.21	OT 0	$\bar{X}$=0.00
Ml 0
M2 0
OT 0

SUMMARY OF NORMALS

100 75 100 100 0 100 100 97 93 0

SEX M: 0 F: 0 U: 0

GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 2f.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-044B
SPECIES: SF
STRAIN: SU
UNIT: POND 1
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS:

LOCATION: MC
AUTOPSY DATE: 02/20/92
AGE: JW
SAMPLE SIZE: 30

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	120.20	9.49	7.89
WEIGHT	18.60	4.57	0.25
KTL*	1.05	6.15	5.86
CTL**	0.00	0.00	0.00
HEMATOCRIT	42.90	5.35	6.95
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	8.48	1.59	0.19

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES		GILLS		PSEUDO-BRANCHES		THYMUS		MESEN. FAT		SPLEEN		HIND GUT		KIDNEY		LIVER		BILE	
N	30	N	22	N	30	0	30	0	0	B	0	0	30	N	30	A	00		4
Bl	0	F	8	S	0	1	0	1	1	R	3	0	1	0	s	0	B	28	1 26
B2	0	C	0	L	0	2	0	2	2	G	0	2	0	M	0	C	22		0
El	0	M	0	S&L	0			3	14	NO	0			G	0	D	03		0
E2	0	P	0	I	0			4	13	E	0			U	0	E	0		
H1	OOT		0	OT	0	$\bar{X}$= 0.00				OT	0	$\bar{X}$= O.OOT			0	F	0		
H2	0			0	0			$\bar{X}$= 3.30								OT	0	$\bar{X}$=0.87	
Ml	0																		
M2	0																		
OT	0																		

SUMMARY OF NORMALS

100	64	100	100	0	100	100	100	93	0	

SEX M: 0 F: 0 U: 0

GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 29.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-057a
SPECIES: STA
STRAIN: HC
UNIT: RWY 13
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D.MUNSON
REMARKS: DENSITY INDEX .27

LOCATION: NS
AUTOPSY DATE: 03/03/92
AGE: JW
SAMPLE SIZE: 10

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	189.10	25.03	0.13
WEIGHT	71.37	25.34	0.36
KTL*	1.01	0.02	0.02
CTL**	0.00	0.00	0.00
HEMATOCRIT	39.00	5.50	0.14
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	4.92	0.38	0.08

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES		GILLS		PSEUDO-BRANCHES		THYMUS		FAT		SPLEEN		HIND GUT		KIDNEY		LIVER		BILE	
N	10	N	6	N	10	0	10	0	0	B	9	0	10	N	10	A	3	0	1
Bl	OF	4	S	0		1	0	1	0	R	1	1	0	s	0	B	7	1	0
B2	OC	0	L	0		2	0	2	0	G	0	2	O	M	0	c	02		8
El	OM	0	S&L	0				3	0	NO	0			G	0	D	03		1
E2	OP	0	I	0				4	10	E	0			U	0	E	0		
H1	OOT	0	OT	0		$\bar{X}$= 0.00				OT	0	$\bar{X}$= 0.00		T	0	F	0		
H2	0		0	0				$\bar{X}$= 4.00								OT	0	$\bar{X}$=0.00	
Ml	0																		
M2	0																		
OT	0																		

SUMMARY OF NORMALS

100	60	100	100	0	100	100	100	100	0

SEX M: 0 F: 0 U: 0

GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 2h.

SUMMARY **OF FISH AUTOPSY**

ACCESSION NO: 92-057B
SPECIES: STA
STRAIN: HC
UNIT: RWY 11
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS: DENSITY INDEX .20

LOCATION: NS
AUTOPSY DATE: 03/03/92
AGE: **JW**
SAMPLE SIZE: 10

	MEAN	STANDARD DEVIATION	COEFFICIENT **OF VARIATION**
LENGTH	202.10	19.96	**0.10**
WEIGHT	87.97	**22.55**	**0.26**
KTL*	1.04	**0.04**	**0.04**
CTL**	0.00	**0.00**	**0.00**
HEMATOCRIT	36.30	**4.80**	**0.13**
LEUCOCRIT	0.00	**0.00**	**0.00**
SERUM PROTEIN	**5.33**	**0.46**	**0.09**

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES	GILLS	PSEUDO-BRANCHES	THYMUS	MESEN. FAT	SPLEEN	HIND GUT	KIDNEY	LIVER	BILE
N 10	N 8	N 0	0 0	0	B **8**	**0** 10	N 10	A **60**	**0**
Bl OF 2	S 0	1 0	1 0	R **2**	**1** **0**	**s** **0**	**B** **4**	**1** **0**
B2 OC 0	L 0	**2** **0**	**2** 0	**G** **0**	**2** O	M 0	c **02**	**0**
El OM 0	S&L 0		3 **0**	**NO** 0		**G** 0	D **03**	**0**
E2 **OP** **0**	**I** **0**		4 10	E 0		U 0	E 0	
Hl OOT 0	OT 0	$\bar{X}$= 0.00		OT 0	$\bar{X}$= 0.00	OT 0	F 0	
H2 0	0 0		$\bar{X}$= **4.00**				OT 0	$\bar{X}$=0.00
Ml 0								
M2 0								
OT 0								

SUMMARY OF NORMALS

100 **80** 100 100 0 100 100 100 **100** **0**

SEX **M:** 0 F: 0 U: 0

GENERAL REMARKS

FINS: GONADS:

SKIN: **OTHER:**

Table 2i.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-057c
SPECIES: STA
STRAIN: HC
UNIT: 10
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS: DENISITY INDEX .25

LOCATION: NS
AUTOPSY DATE: 03/03/92
AGE: JW
SAMPLE SIZE: 10

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	219.60	14.40	0.07
WEIGHT	117.85	29.82	0.25
KTL*	1.09	0.10	0.09
CTL**	0.00	0.00	0.00
HEMATOCRIT	38.30	5.33	0.14
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	5.77	0.41	0.07

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES		GILLS		PSEUDO-BRANCHES		THYMUS		MESEN. FAT		SPLEEN		HIND GUT		KIDNEY		LIVER		BILE	
N	10	N	9	N	10	0	10	0	0	B	8	0	10	N	10	A	80		6
Bl	0	F	1	S	0	1	0	1	0	R	2	1	0	s	0	B	2	1	2
B2	0	C	0	L	0	2	0	2	0	G	0	2	0	M	0	c	02		2
El	0	M	0	S&L	0			3	0	NO	0			G	0	D	03		0
E2	0	P	0	I	0			4	10	E	0			U	0	E	0		
Hl		OOT	0	OT	0	$\bar{X}$= 0.00				OT	0	$\bar{X}$= 0.00		OT	0	F	0		
H2	0			0	0			$\bar{X}$= 4.00								OT	0	$\bar{X}$=0.00	
Ml	0																		
M2	0																		
OT	0																		

SUMMARY OF NORMALS

100	90	100	100	0	100	100	100	100	0

SEX M: 0 F: 0 U: 0

GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 2j.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-058a
SPECIES: STA
STRAIN: PAH
UNIT: 7
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): **D.** MUNSON
REMARKS: DENSITY INDEX .14

LOCATION: NS
AUTOPSY DATE: 03/03/92
AGE: JW
SAMPLE SIZE: **10**

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	256.00	15.92	0.06
WEIGHT	186.86	35.08	0.19
KTL*	1.11	0.09	0.08
CTL**	0.00	0.00	0.00
HEMATOCRIT	38.40	5.02	0.13
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	6.55	1.08	0.16

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES		GILLS		PSEUDO-BRANCHES		THYMUS		MESEN. FAT		SPLEEN		HIND GUT		KIDNEY		LIVER		BILE	
N	10	N	9	N	10	0	10	0	0	B	9	0	10	N	10	A	00		0
Bl	0	F	1	S	0	1	0	1	0	R	1	1	0	s	0	B	10	1	4
B2	0	C	0	L	0	2	0	2	0	G	0	2	0	M	0	C	02		6
El	0	M	0	S&L	0			3	0	NO	0			G	0	D	03		0
E2	0	P	0	I	0			4	10	E	0			U	0	E	0		
Hl	0	OT	0	OT	0	$\bar{X}$= 0.00				OT	0	$\bar{X}$= 0.0	OT		0	F	0		
H2	0			0	0			$\bar{X}$= 4.00								OT	0	$\bar{X}$=1.60	
Ml	0																		
M2	0																		
OT	0																		

SUMMARY OF NORMALS

100	90	100	100	0	100	100	100	100	0

SEX M: 0 F: 0 U: 0

GENERAL REMARKS

FINS:DORSAL FIN 50-75% COMPLETE.

GONADS:

SKIN:

OTHER:

Table 2k.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-0588
SPECIES: STA
STRAIN: PAH
UNIT: RWY 2
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS: DENSITY INDEX .43

LOCATION: NS
AUTOPSY DATE: 03/03/92
AGE: JW
SAMPLE SIZE: 10

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	**202.40**	25.53	0.13
WEIGHT	**83.28**	30.54	0.37
KTL*	**0.96**	0.06	0.06
CTL**	**0.00**	0.00	0.00
HEMATOCRIT	**41.10**	2.96	0.07
LEUCOCRIT	**0.00**	0.00	0.00
SERUM PROTEIN	4.87	0.55	**0.11**

***EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER**
****CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH** POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES	**GILLS**	PSEUDO-BRANCHES	**THYMUS**	**MESEN.** FAT	SPLEEN	HIND GUT	KIDNEY	**LIVER**	BILE
N 10	N 10	N 10	0 10	0 0	B 10	0 10	N 10	A 10	0
Bl 0F 0	S 0	1 0	1 0	R 0	1 0	s 0	B 9	1 0
B2 OC 0	L 0	2 0	2 0	G 0	2 O	M 0	c 02	1
El OM 0	S&L 0	3 0	NO 0	G 0	D 03	9
E2 **OP 0**	**I 0**	4 10	E 0	U 0	E 0
Hl OOT 0	OT 0	$\bar{X}$= 0.00	OT 0	$\bar{X}$= O.OOT 0	F 0
H2 0	0 0	$\bar{X}$= 0.00	OT 0	$\bar{X}$=2.90
Ml 0
M2 0
OT 0

SUMMARY OF NORMALS

100	100	100	100	0	100	100	100	100	0

SEX M: 0 F: 0 U: 0

GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 21.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-058C
SPECIES: STA
STRAIN: PAH
UNIT: RWY 5
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS: DENSITY .26

LOCATION: NS
AUTOPSY DATE: **03/03/92**
AGE: JW
SAMPLE SIZE: 10

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	225.80	10.10	0.04
WEIGHT	114.64	17.26	0.15
KTL*	0.99	0.05	0.05
CTL**	0.00	0.00	0.00
HEMATOCRIT	0.00	0.00	0.00
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	0.00	0.00	0.00

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES		GILLS		PSEUDO-BRANCHES		THYMUS		MESEN. FAT		SPLEEN		HIND GUT		KIDNEY		LIVER		BILE	
N	10	N	10	N	10	0	10	0	0	B	10	0	10	N	10	A	50		0
Bl	0	F	0	S	0	1	0	1	0	R	0	1	0	s	0	B	5	1	0
B2	0	C	0	L	0	2	0	2	0	G	0	2	0	M	0	c	02		1
El	0	M	0	S&L	0			3	0	NO	0			G	0	**D**	03		9
E2	0	P	0	I	0			4	10	E	0			U	0	E	0		
Hl	0	OT	0	OT	0	$\bar{X}$= 0.00				OT	0	$\bar{X}$= 0.0	OT		0	F	0		
H2	0			0	0			$\bar{X}$= 4.00								OT	0	$\bar{X}$=2.90	
Ml	0																		
M2	0																		
OT	0																		

SUMMARY OF NORMALS

100	100	100	100	0	100	100	100	100	0

SEX M: 0 F: 0 U: 0

GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 2m.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-050
SPECIES: SU
STRAIN: PAH
UNIT:
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS:

LOCATION: PH
AUTOPSY DATE: 02/26/92
AGE: JW
SAMPLE SIZE: 60

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	128.10	15.27	0.20
WEIGHT	25.40	13.13	0.52
KTL*	1.16	1.16	0.10
CTL**	0.00	0.00	0.00
HEMATOCRIT	47.88	16.66	0.35
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	7.48	4.37	0.58

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES		GILLS		PSEUDO-BRANCHES		THYMUS		MESEN. FAT		SPLEEN		HIND GUT		KIDNEY		LIVER		BILE	
N	60	N	57	N	60	0	60	0	**OB**	**60**		**0**	60	N	60	A	0	0	10
Bl	OF	3		S	0	1	0	1	0	R	0	1	0	s	0	B	60	1	50
B2	OC	0		L	0	2	0	2	**1**	**G**	0	2	O	M	0	c	02		0
El	OM	0		S&L	0			3	4	NO	0			G	**0**	**D**	03		0
E2	OP	0		I	0			4	55	E	0			U	0	E	0		
Hl	OOT	0		OT	0	$\bar{X}$= 0.00				OT	0	$\bar{X}$= O.OOT			0	F	0		
H2	0			0	0			$\bar{X}$= 3.90								OT	0	$\bar{X}$=0.83	
Ml	0																		
M2	0																		
OT	0																		

SUMMARY OF NORMALS

100	951	100	100	0	100	100	100	100	0

SEX M: 0 F: 0 U: 0

GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 2n.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-043
SPECIES: RR
STRAIN: SC
UNIT:
REASON FOR AUTOPSY: PRELIBERTION
INVESTIGATOR(S): D. MUNSON
REMARKS:

LOCATION: RR
AUTOPSY DATE: 02/19/92
AGE: JW
SAMPLE SIZE: 60

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	119.90	8.62	0.07
WEIGHT	17.90	4.23	0.23
KTL*	0.97	0.23	0.24
CTL**	0.00	0.00	0.00
HEMATOCRIT	43.00	4.26	0.10
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	6.58	1.34	0.20

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES		GILLS		PSEUDO-BRANCHES		THYMUS		MESEN. FAT		SPLEEN		HIND GUT		KIDNEY		LIVER		BILE	
N	57	N	31	N	60	0	60	0	0	B	13	0	60	N	60	A	59	0	15
Bl	0	F	29	S	0	1	0	1	7	R	26	1	0	s	0	B	0	1	45
B2	O	C	0	L	0	2	0	2	15	G	0	2	O	M	0	C	02		0
El	O	M	0	S&L	0			3	21	NO	0			G	0	D	03		0
E2	3	P	0	I	0			4	17	E	0				0	E	1		
Hl		OOT	0	OT	0		0.00			OT	0		0.00		0	F	0		
H2	0			0	0		X= 2.80									OT	0	X=	0.00
Ml	0																		
M2	0																		
OT	0																		

SUMMARY OF NORMALS

95 52 100 100 0 98 100 100 98 0

SEX M: 0 F: 0 U: 0

==========

GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 20.

SUMMARY OF **FISH** AUTOPSY

ACCESSION NO: 92-0513
SPECIES: SC
STRAIN: EF
UNIT: 2A
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS: DENSITY -06

LOCATION: ST
AUTOPSY DATE: 02/27/92
AGE: **JW**
SAMPLE SIZE: 30

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	119.73	6.32	0.05
WEIGHT	17.73	3.14	0.18
KTL*	1.03	0.06	0.06
CTL**	0.00	0.00	0.00
HEMATOCRIT	43.30	4.98	0.12
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	4.89	1.05	0.21

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES	GILLS	PSEUDO-BRANCHES	THYMUS	MESEN. FAT	SPLEEN	HIND GUT	KIDNEY	LIVER	**BILE**
N 28	N 29	N 30	0 30	0 0	B 0	0 30	N 29	A 00	0
Bl OF	1	S 0	1 0	1 0	R 301	0	s 0	B 291	0
B2 2C	0	L 0	2 0	2 **1G**	0	2 O	M 1	**C** 12	0
El OM	0	S&L 0	3	13	NO 0	G	0	D 03	0
E2 2P	0	I 0	4	16	E 0	U	0	E 0	
H1 OOT	0	OT 0	$\bar{X}$= 0.00	OT	0	$\bar{X}$= 0.00T	0	F 0	
H2 0		0 0		$\bar{X}$= 3.50				OT 0	$\bar{X}$=0.00
Ml 0									
M2 0									
OT 0									

SUMMARY OF NORMALS

93 97 100 100 0 100 100 97 97 0

SEX M: 0 F: 0 U: 0

==========

GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 2p.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-051C
SPECIES: SC
STRAIN: EF
UNIT: 1A
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS: BKD DENSITY INDEX -15

LOCATION: ST
AUTOPSY DATE: 02/27/92
AGE: JW
SAMPLE SIZE: 30

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	107.80	7.22	0.07
WEIGHT	12.85	2.76	0.21
KTL*	1.01	0.05	0.05
CTL**	0.00	0.00	0.00
HEMATOCRIT	44.50	2.84	0.06
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	6.10	1.21	0.20

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES		GILLS		PSEUDO-BRANCHES		THYMUS		MESEN. FAT		SPLEEN		HIND GUT		KIDNEY		LIVER		BILE	
N	29	N	29	N	28	0	30	0	0	B	0	0	30	N	29	A	0	0	17
Bl	1F		1	S	0	1	0	1	6	R	3	0	1	0	s	0	B	30	1	13
B2	O	C	0	L	2	2	0	2	10	G	0	2	O	M	1	C	02		0	
El	O	M	0	S&L	0			3	14	NO	0			G	0	D	03		0	
E2	O	P	0	I	0			4	0	E	0			U	0	E	0			
Hl	OOT		0	OT	0	$\bar{X}$= 0.00				OT	0	$\bar{X}$= 0.00		T	0	F	0			
H2	0			0	0			$\bar{X}$= 2.26								OT	0	$\bar{X}$=0.00	
Ml	0																		
M2	0																		
OT	0																		

SUMMARY OF NORMALS

97	97	94	100	0	100	100	7	100	0

SEX M: 0 F: 0 U: 0

GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 2r.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-052A
SPECIES: SC
STRAIN: SAW
UNIT: 7A
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS: MEDIUM DENSITY .16

LOCATION: ST
AUTOPSY DATE: 02/27/92
AGE: JW
SAMPLE SIZE: 20

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	106.50	8.92	0.08
WEIGHT	11.90	3.12	0.26
KTL*	0.99	1.36	0.14
CTL**	0.00	0.00	0.00
HEMATOCRIT	40.60	2.50	0.06
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	4.91	1.08	0.22

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES		GILLS		PSEUDO-BRANCHES		THYMUS		MESEN. FAT		SPLEEN		HIND GUT		KIDNEY		LIVER		BILE	
N	20	N	20	N	20	0	20	0	0	B	0	0	20	N	20	A	00		3
Bl	0	F	0	S	0	1	0	1	0	R	2	0	1	0	s	0	B	16	1 17
B2	0	C	0	L	0	2	0	2	3	G	0	2	0	M	0	c	42		0
El	0	M	0	S&L	0			3	9	NO	0			G	0	D	03		0
E2	0	P	0	I	0			4	8	E	0			U	0	E	0		
Hl	0	OT	0	OT	0	$\bar{X}$= 0.00				OT	0	$\bar{X}$= 0.0	OT		0	F	0		
H2	0			0	0			$\bar{X}$= 3.25								OT	0	$\bar{X}$=0.00	
Ml	0																		
M2	0																		
OT	0																		

SUMMARY OF NORMALS

100 100 100 100 0 100 100 100 80 85

SEX M: 0 F: 0 U: 0

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GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 2s.

SUMMARY OF FISH AUTOPSY

ACCESSION NO: 92-052B
SPECIES: SC
STRAIN: SAW
UNIT: 1B
REASON FOR AUTOPSY: PRELIB
INVESTIGATOR(S): D. MUNSON
REMARKS: HIGH BKD LOW DENSITY

LOCATION: ST
AUTOPSY DATE: 02/27/92
AGE: JW
SAMPLE SIZE: 20

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	112.90	7.02	0.06
WEIGHT	14.60	2.92	0.20
KTL*	0.99	0.08	0.08
CTL**	0.00	0.00	0.00
HEMATOCRIT	44.15	3.71	0.08
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	5.36	0.97	0.18

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO THE FOURTH POWER

VALUES AS PERCENTS OF TOTAL SAMPLE

EYES	GILLS	PSEUDO-BRANCHES	THYMUS	MESEN. FAT	SPLEEN	HIND GUT	KIDNEY	LIVER	BILE
N 20	N 18	N 20	0 20	0 0	B 0	0 20	N 20	A 00	7
Bl 0	F 2	S 0	1 0	1 0	R 2	0 1 0	s 0	B 17	1 13
B2 0	C 0	L 0	2 0	2 0	G 0	2 0	M 0	c 32	0
El 0	M 0	S&L 0		3 6	NO 0	G 0	D 03	0	
E2 0	P 0	I 0		4 14	E 0	U 0	E 0		
Hl 0	OOT 0	OT 0	$\bar{X}$= 0.00	OT 0	$\bar{X}$= 0.00T	0	F 0		
H2 0		0 0		$\bar{X}$= 0.00			OT 0		$\bar{X}$=0.00
Ml 0									
M2 0									
OT 0									

SUMMARY OF NORMALS

100 80 100 100 0 100 100 100 85 0

SEX M: 0 F: 0 U: 0

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GENERAL REMARKS

FINS:

GONADS:

SKIN:

OTHER:

Table 3. Summary of augmented fish health inspections of adult salmon and steelhead at Idaho Columbia River tributary hatcheries.

Powell

Accession	Stock	Date	Results
91-288	Lochsa SC	9/20/91	BK(ELISA) : 1/2+ (low) Viro: 0/3

Red River

Accession	Stock	Date	Results
91-266	Red River SC	**8/31/91**	BK(FAT) 0/1
91-276	Red River SC	**9/10/91**	BK(ELISA) : 2/3+ (mod) Viro: 0/3
91-291	Red River SC	**9/12/91**	BK(ELISA): 2/2+ (1 mod; 1 high)

McCall

Accession	Stock	Date	Results
91-254	SFSU	8/30/91	BK(ELISA): 12/29+ (1 high, 3 mod,8 low) BK(FAT): 2/29+ Viro: 0/39 VE: 0/30

Oxbow

Accession	Stock	Date	Results
92-08	HC STA	1/14/92	PC: 3/40+
92-30	HC STA	2/5/92	PC: 5/18+
92-80	HC STA	3/12/92	Viro: 0/38
92-90	HC STA	3/17/92	Viro: 0/44
92-94	HC STA	3/19/92	Viro: 0/44
92-107	HC STA	3/23/91	Viro: 1/31+ IHNV
92-112	HC STA	3/26/92	Viro: 0/83
92-119	HC STA	3/30/92	Viro: 0/96
92-125	HC STA	4/2/92	Viro: 2/41 pools +IHNV
92-141	HC STA	4/9/92	Viro: 19/27 pools +IHNV
92-198	HC STA	4/10/92	VE: 0/11, BK (ELISA): 1/60 BK (FAT): 0/36

Table 3. continued

Pahsimeroi

Chinook

Accession	Stock	Date	Results
91-252	Pah SU	8/27/91	BK(ELISA): 3/7+(low) Viro:0/7
91-263	Pah SU	9/6/91	BK(ELISA): 1/18+ PW: 1/14+
91-264	Pah SU	8/30/91	BK(ELISA): 0/7 Viro: 0/7
91-265	Pah SU	9/3/91	BK(ELISA): 1/14+ Viro: 0/14
91-278	Pah SU	9/13/91	BK(ELISA): 0/17 Viro: 0/35
91-294	Pah SU	9/20/91	BK(ELISA): 1/5 VE: 0/60
91-299	Pah SU	9/27/91	BK(ELISA): 0/8

Steelhead

92-67	Pah STA	3/9/92	Viro: 0/10
92-81	Pah STA	3/12/92	Viro: 0/30
92-88	Pah STA	3/16/92	Viro: 0/76
92-96	Pah STA	3/19/92	Viro: 0/61
92-103	Pah STA	3/23/91	Viro: 0/64
92-114	Pah STA	3/26/92	Viro: 0/79
92-120	Pah STA	3/30/92	Viro: 0/98
92-127	Pah STA	4/2/92	Viro: 0/43
92-140	Pah STA	4/6/92	Viro: 2/50+ IHNV
92-144	Pah STA	4/9/92	Viro: 0/36
92-149	Pah STA	4/13/92	Viro: 0/38
92-166	Pah STA	4/16/92	Viro: 0/28
92-169	Pah STA	4/20/92	Viro: 0/24

Rapid River

Accession	Stock	Date	Results
92-255	Rapid River	9/3/91	PC: 1/2 pools+, EIBS 0/60, BKD 58/60 (ELISA) 9 high, 18 mod, 31 low

Table 3. continued

Sawtooth

Accession	Stock	Date	Results
Steelhead			
92-113	SAW STA	3/26/92	Viro: 0/15
92-121	SAW STA	3/30/92	Viro: 0/34
92-126	SAW STA	4/2/92	Viro: 0/32
92-138	SAW STA	4/6/92	Viro: 0/120
92-139	EF STB	4/6/92	Viro: 0/5
92-142	SAW STA	4/9/92	Viro: 0/16
92-143	EF STB	4/9/92	Viro: 0/3
92-152	SAW STA	4/13/92	Viro: 0/46
92-153	EF STB	4/13/92	Viro: 0/6
92-165	SAW STA	4/16/92	Viro: 0/15
92-167	EF STB	4/16/92	Viro: 0/12
92-170	EF STB	4/20/92	Viro: 0/6
92-171	SAW STA	4/20/92	Viro: 0/8
92-188	EF STB	4/23/92	Viro: 0/2
92-193	EF STB	4/27/92	Viro: 0/3
92-194	SAW STA	4/6/92	PC: 3/26+ BK(ELISA): 45/60+ (41 low, 4 mod)
92-195	EF STB	4/6/92	BK(ELISA): 9/12+(9 low) PC: 0/35
Chinook			
91-230	SAW SC	8/6/91	BK(FAT): 2/2+ TNTC(Males) 0/3 Females Viro: 0/5
91-234	SAW SC	8/12/91	BK(FAT) :0/1 Bact:Pseudomonas prespawning mortality BK(ELISA) : l/l+ high
91-235	SAW SC	8/9/91	BK(ELISA): 10/11+ Viro: 0/11
91-243	SAW SC	8/21/91	BK(ELISA) : 16/42+ VE: 0/52 Viro: 0/39 PC: 3/17+ PW: 0/17
91-244	EF SC	8/21/91	BK(ELISA): 3/8+ Viro: 0/11 PW: 1/3
91-245	SAW SC	8/21/91	BK(ELISA): O/l
91-247	SAW SC	8/23/91	BK(ELISA): 18/73+ VE: 0/16 Viro: 0/39
91-248	EF SC	8/23/91	BK(ELISA): 1/2+ Viro: 0/2
91-250	SAW SC	8/27/91	BK(ELISA) : 10/61+
91-251	EF SC	8/27/91	BK(ELISA): 4/4+ Viro: 0/4
91-256	SAW SC	8/30/91	BK(ELISA) : 21/59+
91-257	SAW SC	9/3/91	BK(ELISA): 9/40+
91-258	EF SC	9/5/91	BK(ELISA): 1/12 Viro: 0/12
91-272	SAW SC	9/6/91	BK(ELISA) : 7/26+
91-273	EF SC	9/5/91	PC: l/l+ VE: 0/12 PW: 0/8
91-301	EF SC	8/8/91	PC: 9/9+ (heavy)
91 324	RFL SOC	10/21/91	BK(ELISA): O/l

Table 4. Summary of diagnostics and health monitoring of juvenile salmon and steelhead at Idaho Columbia River tributary hatcheries.

Clearwater

Case #	Stock	Date	Results
92-110	Mt.Lass RBT	3/25/92	Viro: 0/10
92-117	Mt.Lass RBT	4/14/92	Viro: 0/15 Bacty: Pseudomonas spp.

Crooked River

91-197	Dwor SC	7/1/91	BK: 0/20 Bacty: 0/4 Viro: 0/20 PI: 0/5
91-222	Dwor SC	8/6/91	Viro: 0/10 PX: 0/10 BK(FAT): 0/10
91-303	Dwor SC	10/8/91	BK(FAT): 0/60 BK(ELISA): 0/60

Powell

91-196	Dwor SC	6/29/91	BK(FAT): 0/20 Bacty: 0/4 Viro: 0/20 PI: 0/5
91-224	Dwor SC	8/9/91	PX: 0/10 BK(FAT): 0/11 Viro: 0/10
91-259	Dwor SC	9/7/91	BK(FAT): 0/12 PW: 0/10
91-305	Dwor SC	10/10/91	BK(FAT): 0/60 BK(ELISA): l/l (high)
92-109	Dwor SC	3/24/92	Viro: 0/15 BK(FAT): 0/19 BK(ELISA): 1/2 + pools(low)

Red River

91-198	Dwor SC	7/2/91	BK(FAT): 0/20 Viro: 0/20 PI: 0/5
91-223	Dwor SC	8/7/91	Viro: 0/10 PX: 0/10 BK:0/10
91-236	Dwor SC	8/15/91	PI: l/l + formalin trt.recommended
91-262	Dwor SC	9/10/91	BK(FAT): 0/10 PW: 0/10
91-304	Dwor SC	10/9/91	BK(FAT): 0/60 BK(ELISA): 0/60
92-108	Dwor SC	3/23/91	BK(FAT): 0/15 BK(ELISA): 0/20 Viro: 0/20

Table 4. continued

Magic Valley

Case #	stock	Date	Results
91-166	91 Pah STA	5/29/91	Viro: 0/10
91-167	91 HC STA	5/29/91	Viro: 0/10
91-168	91 Dwor STB	5/29/91	Viro: 0/10
91-188	91 Saw/HC STA	6/21/91	Viro: 0/10
91-189	91 EF STB	6/21/91	Viro: 0/10
91-190	91 Dwor STB	6/21/91	Viro: 0/10,1/8 MAS, 0/4 BC
91-202	91 Pah STA	7/10/91	Viro: 0/10, Bacty 0/4
91-203	91 EF STB	7/10/91	Viro: 1/2 pools+ IHNV
91-204	91 HC STA	7/10/91	Viro: 0/10, Bacty 0/4
91-205	91 Dwor STB	7/10/91	Viro: 0/10, Bacty 0/4
91-238	91 Dwor STB	8/21/91	Viro: 0/10, BK 0/10
91-239	91 EF STB	8/21/91	Viro: 0/10, BK 0/10
91-240	91 Pah STA	8/21/91	Viro: 0/10, BK 0/10
91-241	91 HC STA	8/21/91	Viro: 0/10, BK 0/10
91-283	91 Dwor STB	9/23/91	Viro: 0/10, Bacty 0/4
91-284	91 Pah STA	9/23/91	Viro: 0/10, Bacty 0/4
91-285	91 EF STB	9/23/91	Viro: 0/10, Bacty 0/4
91-286	91 HC STA	9/23/91	Viro: 0/10, Bacty 4/4 Alcalisenes, Pseudomonas spp. Ps. maltophila
91-313	91 EF STB	10/17/91	BK(FAT) 0/12
91-314	91 Dwor STB	10/17/91	BK(FAT) 0/12
91-315	91 HC STA	10/17/91	BK(FAT) 0/12
91-316	91 Pah STA	10/17/91	BK(FAT) 0/12
92-09	91 EF STB	1/16/92	Viro: 0/10, Bacty 0/4
92-10	91 Dwor STB	1/16/92	Viro: 0/10, Bacty 0/4
92-11	91 Pah STA	1/16/91	Viro: 0/5, Bacty 0/4
92-12	91 HC STA	1/16/91	Viro: 0/10, Bacty 0/4
92-59	91 HC STA	3/4/92	Viro: 0/15, BK (ELISA & FAT) 0/15
92-60	91 Pah STA	3/4/92	Viro: 0/15, BK (ELISA & FAT) 0/15
92-61	91 EF STB	3/4/92	Viro: 0/15, BK (ELISA & FAT) 0/15
92-62	91 Dwor STB	3/4/92	Viro: 0/15, BK (ELISA & FAT) 0/15

Table 4. continued

McCall Hatchery

Case #	stock	Date	Results
91-58	SFSU	3/19/91	Bacty: 1/4 *Flavobacterium* Viro: 0/10
91-83	SFSU	4/9/91	PC: 0/6 PI: 0/6
91-138	SFSU	5/7/91	Bacty: 0/10
91-171	SFSU	6/3/91	Viro: 0/10 BK: 0/10 Bacty: 0/4
91-209	SFSU	7/19/91	BK: 0/60 PW: 0/60 Viro: 0/60
91-220	SFSU	8/6/91	PX: 0/10 BC: 0/10 Viro: 0/10
91-253	SFSU	8/30/91	Viro: 0/10 BK: 0/10 Bacty: 0/4
91-329	SFSU	10/23/91	Bacty: 0/8
92-44	SFSU	2/20/91	BK(ELISA): 6/6+(2 high, 3 low, 1 mod) (10 fish/pool) BK(FAT): 13/60+ Viro: 0/60

Niagara Springs

91-143	Pah STA	5/13/91	Viro: 0/5 Bacty: 0/4
91-165	Wallowa STA	5/29/91	Viro: 0/20
91-183	HC STA	6/18/91	Viro: 0/10
91-186	HC STA	6/14/91	Viro: 0/8 Bacty: 0/4
91-187	HC STA	6/21/91	Viro: 0/10 Bacty: 0/4
91-201	Wallowa STA	7/10/91	Viro: 0/10 Bacty: 0/4
91-232	HC STA	8/14/91	Viro: 0/10 PX: 0/10
91-232			Bacty:0/4
91-233	Wallowa STA	8/14/91	Bacty: 0/4 PX: 0/10 Viro: 0/10
91-237	Wallowa STA	8/20/91	Viro: 0/150 BK:0/156(FAT)
91-282	HC/Pah STA	9/23/91	Viro: 0/10 Bacty: 3/4+ *Ps. maltophila*
91-311	HC STA	10/17/91	BK (FAT): 0/12 Bacty: 0/8
91-312	Pah STA	10/17/91	BK (FAT): 0/12 Bacty: 0/8
92-01	HC STA	1/6/92	Viro: 0/10 Bacty: nsg
92-02	Pah STA	1/6/92	Viro: 0/10 Bacty: nsg
92-57	HC STA	3/3/92	BK (FAT & ELISA) 0/30 Viro: 0/30
92-58	Pah STA	3/3/92	BK (FAT & ELISA) 0/30 Viro: 0/30

Table 4. continued

Pahsimeroi

Case #	Stock	Date	Results
91-47	Pah SU	3/7/91	Viro: 0/11 BK(FAT): 0/8 Bact: 5/8+MAS
91-155	Pah SU	5/17/91	BK(FAT): 0/10 Bact: 0/8
91-193	Pah SU	6/25/91	Bact: 0/8 Viro: 0/10 BK(FAT): 0/10
91-212	Pah SU	7/24/91	BK(FAT): 0/60 Viro: 0/60 PW: 1/6+
91-215	Pah SU	7/24/91	VE: 0/10
91-225	Pah SU	8/10/91	Viro: 0/10 BK(FAT): 0/10 PX: 0/10
91-293	Pah SU	9/25/91	BK(FAT): 0/12 Viro: 0/10
92-04	Pah SU	1/8/92	Bact: 6/8+ Flexibacter PW: 0/10 Viro: 0/10
92-50	Pah SU	2/26/92	BK(ELISA): 5/6+ pools (low) BK(FAT): 0/60 Viro: 0/60

Rapid River

Case #	Date	Data
91-57	3/19/91	0/10 viro, 0/4 bacte
91-84	4/9/91	0/6 ectoparasites
91-139	5/7/91	0/10 BKD, 0/8 bacte
91-172	6/3/91	0/11 BKD, 0/4 bacte
91-207	7/11/91	0/60 BKD, 0/4 bacte, 0/60 PW, 0/60 viro
91-221	8/6/91	0/10 viro, BKD, PKX
92-14	1/21/92	0/5 viro
92-43	2/19/92	BKD FAT 3/60, 0/60 viro

Table 4. continued

Sawtooth

Case#	Stock	Date	Results
91-153	EF SC	5/17/91	BK(FAT): 12/18+ Bacty: +MAS
91-154	SAW SC	5/17/91	BK(FAT): 4/8+ Bacty: 0/4
91-191	EF SC	6/25/91	BK(FAT): 0/10 Viro: 0/10 Bacty: 0/8
91-192	SAW SC	6/25/91	BK(FAT): 0/10 Viro: 0/10 Bacty: 0/8
91-210	SAW SC	7/23/91	BK(FAT): 0/60 Viro: 0/60 PW: 0/65
91-211	EF SC	7/23/91	BK:(FAT): 10/60+(7 TNTC) Viro: 0/60 PW: 0/60
91-213	RR SC	7/23/91	BK(FAT): 0/4 Bacty: 1/4+MAS Viro: 0/4
91-216	RR SC	7/26/91	Bacty: 2/12+BC
91-226	SAW SC	8/10/91	BK (FAT) : 0/10 PX: 0/10 Viro: 0/10
91-227	SAW SC	8/10/91	BK(FAT): 5/11+ PX: 0/10 Viro: 0/10
91-258	EF SC	9/5/91	BK(FAT): 1/12 Viro: 0/10
91-261	SAW SC	9/5/91	BK(FAT): 0/12 Viro: 0/10
91-292	RR SC	9/25/91	Viro: 0/60 BK(ELISA): l/l+ BK(FAT): 2/60+
91-336	SAW SC	10/28/91	BK(FAT): 0/12
91-337	SAW SC	10/28/91	BK(FAT): 0/12
92-03	SAW SC	1/9/92	Viro: 0/10 PW: 0/7 Bacty: 3/8+ Flexibacter spp.
92-05	EF SC	1/9/92	Bacty: 6/8+ Flexibacter spp. Viro: 0/10 PW: 0/8
92-51	EF SC	2/27/91	BK(ELISA): 6/6+(5 high,1 low) BK(FAT): 0/60 Viro: 0/60
92-52	SAW SC	2/27/91	BK(ELISA): 4/6+(2 high,2 low) BK(FAT): 3/60+ Viro: 0/60

Table 5a.

MAGIC VALLEY HATCHERY

MO/YR	STOCK	NO.FISH	FISH/kg	AVG TEMP.(C)	FLO.IND.	DEN.IND	%MORT
JUN91	91PAHST	103571	741.3	15.1	1.20	0.35	0.58
JUN91	91EFST	81621	3460.4	15.1	0.36	0.10	2.67
JUN91	91DWORST	969357	612.2	15.1	0.65	0.38	1.41
JUN91	91OXBST	1007565	606.2	15.1	0.64	0.47	1.99
JUL91	91PAHST	103102	356.3	15.1	0.26	0.19	0.45
JULY1	91EFST	81425	549.0	15.1	0.18	0.12	0.68
JUL91	91DWORST	944927	229.4	15.1	0.54	0.27	0.26
JUL91	91OXBST	1004713	211.6	15.1	0.61	0.25	0.28
AUG91	91PAHST	113135	123.5	15.1	0.39	0.22	0.23
AUG91	91EFST	81327	194.3	15.1	0.21	0.23	0.12
AUG91	91DWORST	943480	93.4	15.1	0.56	0.21	0.15
AUG91	91OXBST	1003099	84.3	15.1	0.64	0.22	0.16
SEP91	91PAHST	112917	65.5	15.1	0.60	0.16	0.16
SEP91	91EFST	81261	111.3	15.1	0.30	0.17	0.05
SEP91	91DWORST	941445	54.4	15.1	0.81	0.21	0.15
SEP91	91OXBST	999452	47.8	15.1	0.94	0.25	0.20
OCT91	91PAHST	112166	34.7	15.1	0.46	0.24	0.06
OCT91	91EFST	84769	48.5	15.1	0.28	0.30	0.11
OCT91	91DWORST	953124	35.8	15.1	0.54	0.29	0.13
OCT91	91OXBST	1016537	31.8	15.1	0.63	0.33	0.13
NOV91	91PAHST	112033	22.4	15.1	0.53	0.16	0.12
NOV91	91EFST	84723	33.9	15.1	0.30	0.19	0.05
NOV91	91DWORST	952294	25.7	15.1	0.59	0.18	0.09
NOV91	91OXBST	1016004	22.6	15.1	0.68	0.21	0.05
DEC91	91PAHST	111998	15.4	15.1	0.73	0.21	0.03
DEC91	91EFST	84714	24.7	15.1	0.40	0.24	0.01
DEC91	91DWORST	951956	17.6	15.1	0.81	0.23	0.04
DEC91	91OXBST	1015646	15.7	15.1	0.94	0.26	0.04
JAN92	92PAHST	111956	12.0	15.1	0.86	0.24	0.04
JAN92	92EFST	84690	17.1	15.1	0.51	0.30	0.03
JAN92	92DWORST	951537	13.9	15.1	0.95	0.27	0.04
JAN92	920XBST	1015214	12.5	15.1	1.08	0.31	0.04
FEB92	92PAHST	1120747	10.1	15.1	1.16	0.35	0.03
FEB92	92EFST	337207	10.4	15.1	0.90	0.32	0.04
FEB92	92DWORST	656883	11.5	15.1	0.99	0.30	0.06
MAR92	92PAHST	1120299	7.7	15.1	1.45	0.41	0.04
MAR92	92EFST	337031	8.6	15.1	1.06	0.37	0.05
MAR92	92DWORST	656369	8.8	15.1	1.24	0.43	0.08
APR92	92PAHST	1094200	8.4	15.1			0.07
APR92	92EFST	334700	9.7	15.1			0.03
APR92	92DWORST	633100	10.1	15.1			0.03

PAHST - Pahsmeroi A steelhead
EFST - East Fork B steelhead
DWORST - Dworshak B steelhead
OXBST - Oxbow A steelhead

Table 5b.

McCALL HATCHERY

MO/YR	STOCK	NO.FISH	FISH/kg	AVG TEMP.(C)	FLO.IND	DEN.IND	%MORT
MAY91	90SFSU	981197	823.3	45.0	.60	0.28	0.15
JUN91	90SFSU	920117	180.10	55.0	.60	0.28	0.02
JUL91	90SFSU	925200	95.01	55.0	.49	0.28	0.02
AUG91	90SFSU	925200	46.00	53.0	.49	0.19	0.01
SEP91	YOSFSU	924480	32.20	46.0	.49	0.19	0.009
OCT91	YOSFSU	923953	31.45	45.0	.49	0.19	0.20
NOV91	90SFSU	923798	27.00	40.0	.83	0.15	0.20
DEC91	90SFSU	923680	23.36	39.25	.80	0.14	0.19
DEC91	91SFSU	199060	1186.50	39.25	.80	0.14	0.19
JAN92	90SFSU	923531	23.8	37.0	.80	0.18	0.19
JAN92	91SFSU	608432	836.52	37.0	.81	0.24	0.06
FEB92	YOSFSU	923232	21.994	38.0	.52	0.26	0.19
FEB92	91SFSU	770718	640.82	38.0	.80	0.39	0.01
MAR92	90SFSU	901500	23.78	38.0	.52	0.23	0.19
MAR92	91SFSU	767823	454.73	38.0	.80	0.39	0.01
APR92	91SFSU	766076	273.48	39.0	.30	0.40	0.02

SFSU - South Fork summer chinook

Table 5c.

NIAGARA SPRINGS HATCHERY

MO/YR	STOCK	NO.FISH	FISH/kg	AVG TEMP.(C)	FLO.IND.	DEN.IND	%MORT
MAY91	91PAHST	643580	6350		1.532	0.10	0.01
MAY91	91HCST	612786	6350		1.532	0.10	0.11
MAY91	91WAL	716946	6350		1.532	0.10	0.12
JUN91	PlPAHST	641355	899.8		.31	0.48	0.35
JUN91	91HCST	598489	899.8		.24	0.68	2.93
JUN91	91WAL	714473	899.8		.60	0.27	0.34
JUL91	PlPAHST	640582	209.9		.40	0.15	0.12
JUL91	PlHCST	595744	261.9		.24	0.18	0.36
JUL91	91WAL	704058	476.3		.43	0.16	1.29
AUG91	91PAHST	639771	103.3		.64	0.32	0.13
AUG91	91HCST	594074	126.7		.39	0.29	0.22
AUG91	91WAL	532307	270.4		.84	0.32	0.48
SEP91	PlPAHST	508914	71.8		.26	0.12	0.12
SEP91	91HCST	531309	87.3		.17	0.08	0.27
SEP91	91WAL	528000					
OCT91	PlPAHST	507828	48.5		.33	0.14	0.21
OCT91	PlHCST	529833	61.3		.23	0.08	0.26
NOV91	91PAHST	506806	39.8		.37	0.16	0.16
NOV91	91HCST	528986	43.0		.29	0.10	0.16
DEC91	PlPAHST	506509	25.2		.50	0.22	0.05
DEC91	PlHCST	528481	27.4		.39	0.14	0.10
JAN92	91PAHST	505914	19.1		.67	0.26	0.12
JAN92	91HCST	527625	19.8		.52	0.16	0.16
FEB92	91PAHST	504498	14.0		.80	0.32	0.27
FEB92	PlHCST	525784	15.1		.62	0.20	0.36

PAHST - Pahsimeroi A steelhead
HCST - Hells Canyon A steelhead
WAL - Wallowa

Table 5d.

PAHSIMEROI HATCHERY

MO/YR	STOCK	NO.FISH	FISH/kg	AVG TEMP.(C)	FLO.IND	DEN.IND.	%MORT
APR91	POPAHSU	608001	644.4	8.8	0.81	0.29	0.15
MAY91	90PAHSU	607625	308.9	9.9	0.86	0.02	0.06
JUN91	90PAHSU	607398	148.8	11.8	0.53	0.03	0.04
JUL91	90PAHSU	607096	92.4	15.0	0.75	0.04	0.05
AUG91	POPAHSU	606816	66.4	12.8	0.93	0.04	0.05
SEP91	90PAHSU	606623	57.2	11.8	1.03	0.05	0.03
OCT91	POPAHSU	606526	43.5	9.4	1.12	0.06	0.02
NOV91	90PAHSU	606433	40.8	5.8	1.10	0.06	0.02
DEC91	90PAHSU	606287	40.6	3.4	1.26	0.06	0.03
JAN92	90PAHSU	606143	39.3	3.8	1.29	0.06	0.03
JAN92	91PAHSU	138250	1893.1	4.1	31.52	0.07	0.42
FEB92	POPAHSU	606028	37.2	5.4	1.34	0.06	0.02
FEB92	91PAHSU	264930	1533.0	5.8	73.89	0.14	0.38
MAR92	91PAHSU	263489	773.5	8.6	116.20	0.22	0.54
APR92	91PAHSU	267375	321.6	10.7	212.63	0.37	2.64
MAY92	91PAHSU	261323	199.2	13.2	284.58	0.37	2.26
JUN92	91PAHSU	380538	105.2	12.9	479.57	0.02	0.12
JUL92	91PAHSU	379619	75.1	13.8	738.29	0.03	0.24
AUG92	91PAHSU	379231	56.2	13.2	974.81	0.03	0.08

PAHSU - Pahsimeroi summer chinook

Table 5e.

RAPID RIVER HATCHERY

MO/YR	STOCK	NO.FISH	FISH/kg	AVG TEMP.(C)	FLO.IND.	DEN.IND.	%MORT
APR91	90RRSC	3607206	923.1	6.1	0.93	0.29	0.12
MAY91	90RRSC	3602292	495.9	6.9	3.13	0.27	0.14
JUN91	90RRSC	3196719	246.3	8.3	0.81	0.07	0.03
JUL91	90RRSC	3196200	142.8	12.0	1.14	0.10	0.04
AUG91	90RRSC	3194887	84.8	12.9	1.41	0.14	0.04
SEP91	90RRSC	3191692	66.9	10.9	1.83	0.17	0.10
OCT91	90RRSC	3182724	58.7	7.6	2.39	0.18	0.28
NOV91	90RRSC	3167233	54.6	4.6	2.22	0.19	0.49
DEC91	90RRSC	3152885	55.3	3.1	2.38	0.18	0.45
JAN92	90RRSC	3145912	57.1	3.4	2.10	0.17	0.22
JAN92	91RRSC	417519	2946.1	3.4	0.80	0.28	0.31
FEB92	90RRSC	3136897	51.7	5.2	2.14	0.19	0.29
FEB92	91RRSC	2367875	2692.7	5.2	0.63	0.22	0.49
MAR92	90RRSC	100000	45.6	6.4	0.15	0.04	0.37
MAR92	91RRSC	2382786	1608.4	6.4	0.56	0.20	0.61
APR92	91RRSC	2369769	984.8	7.4	0.67	0.28	0.55
MAY92	91RRSC	2356488	589.4	8.9	0.90	0.40	0.56
JUN92	91RRSC	2393408	309.6	12.0	0.55	0.06	0.25
JUL92	91RRSC	2289828	194.3	13.0	0.69	0.08	0.14

RRSC - Rapid River spring chinook

Table 5f.

SAWTOOTH HATCHERY

MO/YR	STOCK	NO.FISH	FISH/kg	AVG TEMP.(C)	FLO.IND	DEN.IND.	%MORT
FEB91	89SWTSC	**650900**	57.3	3.4	0.48	0.15	0.10
FEB91	89EFSC	**98302**	66.8	3.4	0.35	0.11	0.11
MAR91	90SWTSC	1302383	686.4	3.9	1.41	0.27	0.15
MAR91	90EFSC	86287	642.4	3.9	0.71	0.19	0.26
APR91	90SWTSC	1300290	431.2	6.1	1.6	0.37	0.18
APR91	90EFSC	85910	519.4	6.1	0.81	0.22	0.34
MAY91	90SWTSC	1297830	283.8	7.8	2.11	0.48	0.08
MAY91	POEFSC	84828	259.6	7.8	1.28	0.35	0.25
JUNE91	POSWTSC	1294268	250.8	11.1	0.35	0.11	0.35
JUNE91	90EFSC	84399	257.4	11.1	0.14	0.04	0.36
JULY91	90SWTSC	1288751	167.2	14.4	0.28	0.08	0.44
JULY91	POEFSC	82833	147.4	14.4	0.2	0.06	0.148
AUG91	90SWTSC	1284113	94.6	14.4	0.41	0.13	0.31
AUG91	90EFSC	80991	85.8	14.4	0.28	0.09	0.149
SEP91	POSWTSC	1278250	72.6	11.7	0.48	0.15	0.68
SEP91	90EFSC	80711	68.2	11.7	0.32	0.1	0.27
OCT91	90SWTSC	1278259	61.6	7.7	0.54	0.17	0.09
OCT91	90EFSC	80414	61.6	7.7	0.34	0.11	0.42
NOV91	90SWTSC	1276130	61.6	3.9	0.54	0.17	0.04
NOV91	90EFSC	80288	61.6	3.9	0.34	0.11	0.02
DEC91	90SWTSC	1274813	63.6	2.2	0.54	0.17	0.08
DEC91	90EFSC	80117	61.6	2.2	0.34	0.11	0.19
DEC91	91SWTSC	733872	1775.4	2.2	0.05	0.15	0.49
DEC91	91EFSC	34532	1599.4	2.2	0.04	0.09	0.46
JAN92	90SWTSC	1273699	68.2	2.2	0.52	0.16	0.07
JAN92	90EFSC	79871	66.	2.2	0.32	0.1	0.25
JAN92	91SWTSC	730781	1075.8	2.2	0.68	0.12	0.38
JAN92	91EFSC	34483	950.4	2.2	0.32	0.06	0.14
FEB92	90SWTSC	1272744	68.2	2.8	0.51	0.16	0.04
FEB92	90EFSC	79755	66.	2.8	0.35	0.11	0.11
FEB92	91SWTSC	729361	750.2	2.8	1.02	0.18	0.18
FEB92	91EFSC	34445	706.2	2.8	0.59	0.11	0.11
MAR92	POSWTSC	1271879	66.	5.			
MAR92	POEFSC	79332	57.2	5.			
MAR92	91SWTSC	728359	464.2	5.	1.48	0.26	0.14
MAR92	91EFSC	34364	374.	5.	0.92	0.18	0.24
APR92	91SWTSC	727847	314.6	6.7	1.83	0.32	0.06
APR92	91EFSC	34349	264.	6.7	1.13	0.22	0.04
MAY92	91SWTSC	726848	206.8	10.6	0.25	0.08	0.11
MAY92	91EFSC	34315	165.	10.6	0.17	0.05	0.1

SWTSC - Sawtooth spring chinook
EFSC - East Fork Salmon spring chinook